



Acerca de este libro

Esta es una copia digital de un libro que, durante generaciones, se ha conservado en las estanterías de una biblioteca, hasta que Google ha decidido escanearlo como parte de un proyecto que pretende que sea posible descubrir en línea libros de todo el mundo.

Ha sobrevivido tantos años como para que los derechos de autor hayan expirado y el libro pase a ser de dominio público. El que un libro sea de dominio público significa que nunca ha estado protegido por derechos de autor, o bien que el período legal de estos derechos ya ha expirado. Es posible que una misma obra sea de dominio público en unos países y, sin embargo, no lo sea en otros. Los libros de dominio público son nuestras puertas hacia el pasado, suponen un patrimonio histórico, cultural y de conocimientos que, a menudo, resulta difícil de descubrir.

Todas las anotaciones, marcas y otras señales en los márgenes que estén presentes en el volumen original aparecerán también en este archivo como testimonio del largo viaje que el libro ha recorrido desde el editor hasta la biblioteca y, finalmente, hasta usted.

Normas de uso

Google se enorgullece de poder colaborar con distintas bibliotecas para digitalizar los materiales de dominio público a fin de hacerlos accesibles a todo el mundo. Los libros de dominio público son patrimonio de todos, nosotros somos sus humildes guardianes. No obstante, se trata de un trabajo caro. Por este motivo, y para poder ofrecer este recurso, hemos tomado medidas para evitar que se produzca un abuso por parte de terceros con fines comerciales, y hemos incluido restricciones técnicas sobre las solicitudes automatizadas.

Asimismo, le pedimos que:

- + *Haga un uso exclusivamente no comercial de estos archivos* Hemos diseñado la Búsqueda de libros de Google para el uso de particulares; como tal, le pedimos que utilice estos archivos con fines personales, y no comerciales.
- + *No envíe solicitudes automatizadas* Por favor, no envíe solicitudes automatizadas de ningún tipo al sistema de Google. Si está llevando a cabo una investigación sobre traducción automática, reconocimiento óptico de caracteres u otros campos para los que resulte útil disfrutar de acceso a una gran cantidad de texto, por favor, envíenos un mensaje. Fomentamos el uso de materiales de dominio público con estos propósitos y seguro que podremos ayudarle.
- + *Conserve la atribución* La filigrana de Google que verá en todos los archivos es fundamental para informar a los usuarios sobre este proyecto y ayudarles a encontrar materiales adicionales en la Búsqueda de libros de Google. Por favor, no la elimine.
- + *Manténgase siempre dentro de la legalidad* Sea cual sea el uso que haga de estos materiales, recuerde que es responsable de asegurarse de que todo lo que hace es legal. No dé por sentado que, por el hecho de que una obra se considere de dominio público para los usuarios de los Estados Unidos, lo será también para los usuarios de otros países. La legislación sobre derechos de autor varía de un país a otro, y no podemos facilitar información sobre si está permitido un uso específico de algún libro. Por favor, no suponga que la aparición de un libro en nuestro programa significa que se puede utilizar de igual manera en todo el mundo. La responsabilidad ante la infracción de los derechos de autor puede ser muy grave.

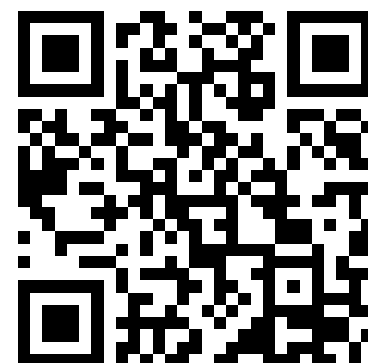
Acerca de la Búsqueda de libros de Google

El objetivo de Google consiste en organizar información procedente de todo el mundo y hacerla accesible y útil de forma universal. El programa de Búsqueda de libros de Google ayuda a los lectores a descubrir los libros de todo el mundo a la vez que ayuda a autores y editores a llegar a nuevas audiencias. Podrá realizar búsquedas en el texto completo de este libro en la web, en la página <http://books.google.com>

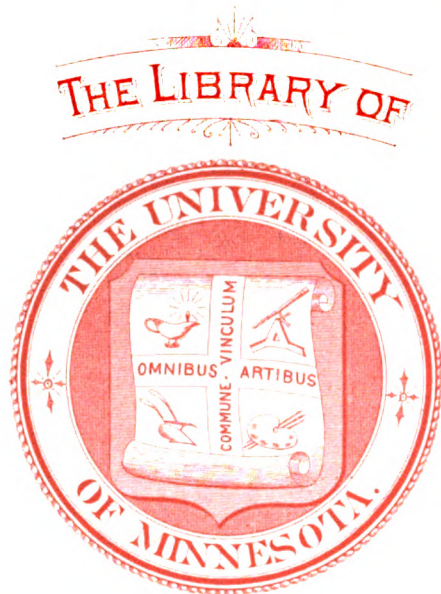
This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

GoogleTM books

<https://books.google.com>



AMSTERDAM BOOK MFG. CO.
313 Hennepin Ave.
Minneapolis, Minn.



ACCESSION.	CLASS	En620.5
19618	BOOK	f El264

ELECTRICITY,

A Popular Electrical and Financial Journal.

PUBLISHED WEEKLY BY

Electricity Newspaper Co.,

136 LIBERTY STREET,

NEW YORK.

VOLUME XIV.

Nos. 1 to 26 inclusive.

JANUARY 12, 1898, TO JULY 6, 1898.

INDEX TO ELECTRICITY.

VOLUME XIV—NOS. 1 TO 26 INCLUSIVE.

JANUARY 12, 1898—JULY 6, 1898.

A

Alternate Current Motors, 152.
Alternating Currents and Direct Currents in Lighting, etc. (Discussion), 407.
Amateur Model Making Competition at the Electrical and Kindred Industries Exhibition, 152.
American Association of Inventors and Manufacturers, 10.
An Important Deal Closed, 265.
An Improved Sand Box, 139.
Annual Meeting of the Joseph Dixon Crucible Co., 265.
Annual Meeting of G. E. Co., 281.
Attendants at the N. E. L. A. Convention, 359.

AUTHORS:—

Adams, W. P. (A. I. E. E.), A Survey of the Possibilities of Electrical Heating and Cooking, 117, 133.
Andrews, Leonard, The Prevention of Interruptions to Electricity Supply, 341.
Appleyard, Rollo, Electrical Alloys, 325.
Badt, Lieut. Francois A., Topics of Interest to Central Station Men, 86.
Barbarat, A., Electric Cables With Dry-Air Circulation, 328.
Birkeland, M., On the Cathode Ray Spectrum, 329.
Bleyer, J. Mount, The X-Rays and their Safe Application, 361.
Bouty, E., New Method of Measuring the Intensity of Magnetic Fields, 245.
Byng, G. Binswanger, On the Manufacture of Lamps and Other Apparatus for 200-Volt Circuits, 150.
Clarke, W. G., Wireless Telegraphy, 227, 247, 278.
Cowper-Coles, Sherard, An Electrolytic Process for the Manufacturing of Parabolic Reflectors, 119, 134; Electrolytic Refining of Lead, 294.
Cutler, Harry H., The Regulation and Protection of the Electric Motor, 215.
Diendonne, Emile, System for Protection of Railway Trains, 280.
Dow, Alex., Electric Lighting for Profit, 100.
Edgar, W. H., Physical and Chemical Properties of Volatile Oils in Boilers, 70.
Ewing, Prof. J. A., A Magnetic Balance for Workshop Tests of Permeability, 309.
Fessenden, Reginald A., Insulation and Conduction, 182, 197, 213.
Ferguson, Louis A., General Distribution from Central Stations by Direct Currents, 357, 403.
Gage, Channing T., Biography of a Piece of Copper Wire, 199.
Greene, S. Dana, The Relations Between the Customer, Consulting Engineer and the Electrical Manufacturer, 20.
Hallberg, J. H., A Novel High Tension Series Enclosed Arc System, 184.
Hamelin, G., Electrically Operated Movable Platforms for the Universal Exposition at Paris, 165.
Harrington, Walter E., Railway Bonding, 22.
Hedenberg, W. L., What Electrolyzed Sea Water has Accomplished, 296.
Hedley, W. S. M.D., Death by Electricity, 149.
Jorignot, C., New System of Electric Traction by Alternating Currents, 200.
Kershaw, J. B. C., The Electro-Chemical and Electro-Metallurgical Industries of Europe, 5, 55, 85, 116, 196, 244, 280, 293, 311, 344.
Laffargue, J., The Distribution of Electrical Energy in Paris, 300, 327, 377, 392.

Liebenlow, C., The Calculations of the Electrical Resistances of Alloys and their Application to the Finding of Alloys of Definite Electrical Properties, 69, 83, 100.
McMynn, J. C., The Practice of Theory, 67.
Niblett, J. T., Some Recent Improvements in Accumulators and their Application to Traction on Common Roads, 230.
Owens, Prof. R. B., Electricity in Municipal Engineering, 52.
Powell, Leigh S., Carbonization of Filaments by Electricity, 323.
Preece, W. H., On the Abuse of Power Houses, 393.
Price, W. A., Shielded Conductors, 71.
Randall, John E., The Present Efficiency of Incandescent Lamps, 52.
Ridley, A. E. Brooke, Garbage Destructors, 277.
Rice, Calvin W., Analysis of the Cost of the Generation and Distribution of a Unit of Electricity, 371.
Routin, J. L., Unipolar Self-Exciting Alternator, 38.
Von Kodolitsch, Riveting by Electricity, 265.
Wagner, Herbert A., General Distribution from Central Stations by Alternating Currents, 389, 405.
Wright, J., The Insulation of Electrical Testing Instruments, 22.

B

Beautiful St. John's River, The, 139.
Bids Wanted, 105.
Bids Wanted for Telegraph Material, 265.
BOOK REVIEWS:—
Arithmetic of the Steam Engine, by E. Sherman Gould, 9.
Mechanical Draft, by B. F. Sturtevant, 9.
Motor Engineer's and Electrical Worker's Handbook, by Wm. Lintern, 57.
Anderson's Physical Education, by W. Gilbert Anderson, 57.
A Pocket Dictionary of Electrical Words, Terms and Phrases, by Edwin J. Houston, 152.
Algebra Made Easy, by Edwin J. Houston and Arthur Kennelly, 152.
The Universal Electrical Directory, by J. A. Berly, 152.
Modern Switchboards, by Albert B. Herrick, 232.
Brake in Railway Service, The, 123.
Brush Electric Light Stock Suit, 24.
Business Changes, 107.

C

CANADIAN NOTES:—
Pages 9, 25, 73, 153, 169, 233, 266, 296, 313, 330, 362, 394.
Cathode and Roentgen Rays, 105.
Changing Alternating to Direct Current, 68.
Cheap Telephone Lines, 3.
Chicago Convention, 355.
Chicago Electrical Association, 73.
Clontarf Electric Tramway, 6.
COMMUNICATIONS:—
The Warren Electric Co., receivership, 153.
The Firman Patent, 195.
Congressional Notes, 24, 201.
Cork Electric Tramway, 295.
Costly Litigation, 212.
Creating an Electrical Town, 54.

COMMERCIAL PARAGRAPHS:—

Pages 11, 27, 43, 59, 75, 91, 107, 123, 139, 155, 171, 187, 203, 219, 235, 251, 267, 283, 299, 315, 331, 347, 364, 380, 395, 411.

D

Desirable Books, 74.
Drawbacks—The Kind to Get, 89.
Draw Your Dividends, 55.
Dublin Three-Phase System, 152.

E

EDITORIAL NOTES:—

Amendment to Patent Laws, 193.
An Electrically Propelled Cruiser, 241.
An Electric Fire Engine, 290.
An Electric Ice Boat, 66.
Another Vacuum Tube Light, 162.
Another Patent Decision Against the G. E. Co., 294.
Another Important Patent Decision, 337.
Another Startling Invention, 385.
Automobile Exposition in Paris, The, 385.
Cast Iron as an Insulator, 65.
Changes in the Patent Office, 354.
Como International Exhibition of Electricity, The, 401.
Conference of the Union for the Protection of Industrial Property, 242.
Courts End the Trust Monopoly, 209.
Diesel Motor, The, 114.
Early Application of Electricity to Submarine Mines, 241.
Effect of War on the Electrical Industry, 258.
Electric Headlights, 93.
Electric Fish Torpedoes, 146.
Electric Light in Italy, 338.
Electric Semaphore Signals, 66.
Electrical Equipment of the Alabama, 386.
Electrical Exhibition, 210, 290.
Electrical Resistance of Alloys, The, 65.
Electrical War Inventions Pouring into the Patent Office, 26.
Electricity and Trunk Line Railroads, 33.
Electricity for Consumption, 50.
Electricity for the Elevated Roads, 17.
Electricity from the Earth, 33.
Future Fields for Electricity, 178.
Garbage Destructors, 274.
General Electric, 257.
General Electric Stock Problem, 369.
General Opinion Regarding Sixth Annual Report, 273.
Greene's, S. Dana, Paper, 18.
Holland Submarine Boat, The, 178.
Incandescent Lamps, 237.
Kite Telephoning, 370.
Locating Submarine Mines by Means of the Teleautograph, 210.
Long Distance Submarine Telephoning, 162.
Low Cost of Steam Power in Buffalo, 129.
Milwaukee Convention, 34.
Movable Electric Bridge, A, 32.
Municipal vs. Private Ownership, 97.
National Electric Light Convention, 305, 338, 354.
New Electric Conduit System, 193.
New England Gas & Coke Co., 145.
New Method of Insulating an Electric Current, 50.
New Trolley Systems and Snow, The, 82.
New York Electrical Society, 18.
Northwestern Electrical Convention, 274, 369.
Novel Electric Railways, 1.

Opening of the Electrical Exhibition, 257.
 Paris Exposition of 1900, The, 162.
 Philadelphia Exhibition, 386.
 Power Rates of the Cataract & Conduit Co., 226.
 Prize Offer, A, 1.
 Proposed Pan-American Exposition, The, 289.
 Roentgen Rays in Warfare, 402.
 Searchlights, 194.
 Several New Illuminants, 34.
 Startling Theory as to Electricity, 81.
 Steel Foundations of Buildings and Electrolysis, 225.
 Street Railways and Municipalities, 146.
 Submarine Cable Cutting, 354.
 Submarine Mines and Electricity, 113.
 Summer Convention of the Northwestern Electrical Association, 321.
 Technical Education, 129.
 Telephone Bill at Albany, 130.
 Telectroscope, The, 177.
 Telephone Charges, 2.
 Trans-Mississippi and International Exposition, The, 209.
 Trolley for Chicago River, Proposed, 2.
 United States Export Trade, The, 401.
 Uses to which the Telephone is Put, 322.
 Valuable Papers Stolen, 98.
 War Revenue Bill, A, 306.
 War of Science, A, 305.
 Wave and Tide Motors, 194.
 Wind as a Motive Power, 81.
 Wonderful Electric Gun, 18.
 Would-be Blow at Trusts, 306.
 Effect of the War on General Industry, 297.
 Electric Engineering at Columbia University, 131.
 Electric Equipment of the Maine, 135.
 Electric Light Dimmers, 35.
 Electric Lighting of Powder Magazines, 68.
 Electric Lighting of the Thames Embankment, 73.
 Electric Lighting in London, 73.
 Electric Lighting of Trains in India, 246.
 Electric Lighting of Mail Cars in Germany, 198.
 Electric Lighting in Berlin and Paris, 389.
 Electric Mail Cars, 73.
 Electric Opportunities in Peru, 405.
 Electric Plant at West Point Academy, The, 297.
 Electric Power Schemes, 56.
 Electric Progress in Corea, 195.
 Electric Projects in France, 149.
 Electric Railways of Canada, The, 19.
 Electric Railway Projects Abroad, 250.
 Electric Tramways in Cork, 4.
 Electric Tramways in Europe, 105.
 Electric Tramway Schemes, 56.
 Electricity in Coal Pits, 195.
 Electricity in the Hotel and Home, 295.
 Electricity in Municipal Engineering, 53.
 Electricity Supply in Eng'nd, 231, 243.
 Electrical Appliances in South Africa, 329.
 Electrical Applications Awaiting Action in the Patent Office, 105.
 Electrical Apparatus for Great Gull Island, 105.
 Electrical Exhibition, 73, 163, 212, 227, 249, 307.
 Electrical Exhibition, The; a Personal Exhibit by Prof. S. H. Short, 73.
 Electrical Engineering in Spain, 151.
 Electrical Engineering Schools, United, 212.
 Electrical Exports, 9.
 Electrical Show, 8, 73, 168, 195, 212, 227, 249, 259, 275, 291, 307, 323, 340.
 Electrically-Driven Machinery, 294.
 Electrically Driven Tea Factory, The, 4.
 E. M. F. of the Arc With Aluminum Electrodes, 410.
 ELECTRICAL PATENT RECORD:—
 Pages 27, 44, 60, 76, 92, 108, 124, 139, 156, 172, 188, 204, 220, 236, 252, 268, 284, 300, 316, 332, 348, 364, 380, 396.
 ELECTRICAL SECURITIES:—
 Pages 13, 29, 45, 61, 77, 93, 109, 125, 141, 157, 173, 189, 205, 221, 237, 253, 269, 285, 301, 317, 333, 349, 365, 381, 397, 413.

F

First French Electric Railway, The, 4.

G

General Electric's Sixth Annual Report, 261.
 Good Books for Electrical Students and Others, 169.

H

Harrisburg Foundry and Machine Works, The, 105.
 Herz's, Dr., Claim for Indemnity, 24.

I

Illinois Street Railway Association, 339.
 Important Electrical Exhibition Arrangements, 56.
 International Competition for the Phebe Hearst Arc Plant, 25.

International Exhibition in Glasgow, 324.
 International Ohm, The, 183.

INCORPORATIONS:—

Pages 12, 27, 43, 60, 75, 91, 107, 123, 139, 155, 171, 188, 204, 220, 235, 251, 268, 284, 299, 316, 332, 348, 364, 380, 396, 411.

J

Joint International Meeting at Laredo, Texas, 121, 169.

K

Kingsland System of Electric Traction, The, 248.

L

Lamp Company in Trouble, 35.
 Lecture on Electric Engineering, 73.

LEGAL NOTES:—

American Range Finder Co., assignment, 186.
 Bates, Charles Austin, vs. General Electric Co., receiver asked for, 89.
 Barden-Sheets Electrical Construction Co., mortgage, 154.
 Bernstein Electric Co., assignment, 57.
 Blackman, A. W. R., embezzlement, 250.
 Blauvelt vs. Interior Conduit & Insulation Co., infringement, 137.
 Bloomington City Railway Co., property sold, 218.
 Breakenridge, George T., assignment, 121.
 Buffalo, Kenmore & Tonawanda Electric Railway Co. vs. John B. Damont, money, 330.
 California Electric Co. vs. California Safe Deposit Co., damage, 202.
 Calumet Electric Railway Co., receiver appointed, 10.
 Campbell Electric Supply Co., receiver, 106.
 Campbell, Frank, damage, 89.
 Cataract General Electric Co., receivership vacated, 121.
 Central Trust Co. vs. J. C. Hubinger, conversion of property, 234.
 Christy, Miss Regina, vs. Northern Electric Light & Power Co., damage, 121.
 City Electric Railway Co. vs. Guarantors' Liability Indemnity Co., damage, 89.
 City of Indianapolis vs. Citizens' Railroad Co., franchise, 234.
 Cole, Wm. R., vs. Detroit Telephone Co., damage, 201.
 Consolidated Car Heating Co. vs. Gold Car Heating Co., infringement, 362.
 Consolidated Car Heating Co. vs. West End Street Railroad, infringement, 137.
 Consolidated Electric Storage Co. vs. Atlantic Trust Co., judgment reversed, 10.
 Davis, Hattie C., vs. Electric Self-Playing Piano Co., damage, 234.
 Detroit Citizens' Street Railway Co., franchise controversy, 330.
 Diehl Mfg. Co. vs. Royce & Marean, infringement, 74.
 Dolgeville Electric Co., receiver appointed, 410.
 Edison Electric Light Co. vs. Minneapolis International Electric Co., infringement, 106, 394.
 Edison Electric Light Co. vs. Doubleday Electric Co., injunction asked for, 154.
 Edison General Electric Co. vs. Western Electric Co., infringement, 105.
 Electrical Railway & Equipment Co. vs. Metropolitan Railway Co. and Capital Traction Co., injunction asked for, 394.
 Farmers' Loan & Trust Co. vs. Salt Lake and Ogden Gas & Electric Light Co. and the Union Light & Power Co., foreclosure suit, 202.
 Fay, James P., vs. Galveston City Railway Co., damage, 169.
 Fisher Electric Mfg. Co., mortgage foreclosure, 121.
 Fort Wayne Electric Co. vs. Franklin Electric Co., money, 10.
 Foulds, Albert, vs. Pennsylvania Insulated Wire Co., receiver asked for, 394.
 General Electric Co. vs. La Grande Edison Electric Co., suit to recover notes, 106.
 General Electric Co., assumption damage, 74.
 Greeley, E. S., & Co., receiver appointed, 105; money, 154.
 Hart & Hegeman Mfg. Co. vs. Anchor Electric Co. et al., injunction asked for, 298.
 Hill, Thomas, and holders of Hudson Telephone Co. stock, receiver asked for, 90.
 Hix, W. Preston, vs. Edison Electric Light Co., damage, 201.
 Holt Electric Storage Co., receiver appointed, 298.
 Hyer vs. Richmond Traction Co., franchise, 25.
 Imperial Electric Co., sold out by sheriff, 234.
 Indiana Traction Co., claims paid, 201.
 Judge, Nellie E., vs. Narragansett Electric Lighting Co., damage, 154.
 Kimball, Willis, vs. West End Street Railway, damage 25

Lake Cities Electric Railroad Co., receiver appointed, 57.
 Lancaster & Susquehanna Turnpike Road Co., Lancaster & Columbia Railway Co., Given, W. B., vs. Columbia Telephone Co., appeal for injunction, 201.
 Leary, J. F., vs. Atlanta Electric Railway Co., mortgage foreclosure, 169.
 Le Roy Gas Light Co., taxes reduced, 201.
 Little, George H., writ of mandamus applied for, 169; writ of mandamus denied, 410.
 Macon Gas Light & Water Co., auction sale of electric light plant, 313.
 Malochee vs. Great Southern Telephone & Telegraph Co., damage, 25.
 Massachusetts Loan & Trust Co. vs. Citizens' Electric Light & Power Co., receiver appointed, 25.
 Melanson, Charles, vs. Thomson-Houston Electric Co., damage, 298.
 McCarthy, Maurice, vs. New York & New Jersey Telephone Co., damage, 282.
 Municipal Electric Light Co., mandatory injunction denied, 282.
 Mutual Electric Light Co., mandate of court asked for, 313.
 National Conduit Co. vs. Talcott H. Russell, patent infringement, 154.
 National Electric Mfg. Co., receiver discharged, 10; receiver ordered to turn over all books and vouchers to court, 151.
 New Jersey Electric Railroad, receiver appointed, 74.
 New York, New Haven & Hartford Railroad Co., appeal for extension not allowed, 57; vs. Fair Haven & Westville Railway Co., damage, 394.
 New York City vs. Metropolitan Street Railway Co., decision of rights as to property, 298.
 New York Security & Trust Co. vs. Saratoga Gas & Electric Co., mortgage foreclosed, 201.
 N. Y. & G. L. R. Co. vs. N. J. E. R. Co., rights as to speed, 313.
 Ohio Storage Battery Co., suit for dissolution and appointment of receiver, 330.
 Old Colony Trust Co. vs. City of Atlanta, ordinance to regulate rates of fares, 316.
 Ongley Electric Co., receiver appointed, 362.
 Ottumwa Electric Railway Co., mortgage foreclosure, 15.
 Ottawa Street Car Co., receiver appointed, 57.
 Owner of Vehicle vs. Street Car Co., damages, 410.
 Packer, Louis M., vs. Thomson-Houston Electric Co., damage, motion for new trial, 10.
 Pelzer, William, vs. Horn & Brannen Mfg. Co., Acme Gas Fixture & Art Metal Co., R. W. Giese & Co., and W. J. Buck's Sons & Co., patent infringement, 370.
 Perkins Electric Switch Mfg. Co. vs. Gibbs Electric Mfg. Co., bill for alleged infringement dismissed, 394.
 Peterson, Senator S. D., vs. Western Union Telegraph Co., suit for libel, 265.
 Pitman Grove, Glassboro & Clayton Electric Light Co., receiver appointed, 105.
 Port Huron Electric Railway Co. vs. Guarantors' Liability & Indemnity Co., damage, 186.
 Praeger, Dr. Louis F., vs. Brooklyn Heights Railroad Co., damage, 298.
 Puritan Electric Co., stock seized, 121.
 Reed, Warren B., and Brainerd R. Rison vs. Edison Electric Light Co., infringement, 279.
 Richmond Railway & Electric Co. vs. Virginia Electric Co., Baltimore, suit for alleged violation of contract, 394.
 Ridall, John E., vs. Brush Electric Co., suit to recover money and goods, 57.
 Roanoke Street Railway and Roanoke Electric Light & Power Co., receiver appointed, 121.
 Rothermel, John H., writ of certiorari granted, 313; contract awarded for lighting Atlantic City, 362.
 Ryan, Leslie W., charge of perjury, 19.
 Sherwood, Robert H., and Ralph C. Swan vs. Maitland F. Graves, money, 89.
 Sprague Electric Railway & Motor Co. vs. Steel Motor Co., Union Railway Co., and Nassau Electric Railroad Co., infringement, 218, 313, 394.
 Staten Island Traction Co., foreclosure sale, 282.
 Supreme Court of Wisconsin, decision entitling property holders to damages against railway companies, 186.
 Tacoma Gas & Electric Light Co. vs. Tacoma City, fraudulent sale, 202, 362.
 Telephone suit, Minneapolis, a novel ruling, 330.
 Teela Electric Co. vs. Davison Fau & Motor Co., injunction asked for, 379.
 Thomson-Houston Electric Co., vs. Astor Orange Railroad Co., Walker Co. and Union Railway Co., Hartford & West Hartford Railroad Co., Minneapolis International Electric Co., infringement, 25, 89, 362, 394.

Thompson, William, vs. Lowell, Lawrence & Haverhill Street Railway Co., damage, 218.
 Todd, Alexander R., vs. Second Avenue Traction Co., damage, 346.
 Virginia Electric Co. vs. Richmond Railway & Electric Co., franchise, 362.
 Warren Electric Co., receiver asked for, 154.
 Western Electric Co. vs. Kellogg Switchboard & Supply Co., appeal for injunction, 362.
 Whitehouse Department Store vs. Edison Electric Co., damage, 121.
 Wilson, Carlos, vs. Thos. W. Bioknell, money, 74.
 Windsor vs. McCaskey-Holcomb Co. et al., injunction asked for, 57.

LONDON NOTES:—

Pages 11, 56, 73, 105, 152, 201, 233, 249, 295.
 London's Maximum Current Demand, 41.
 Long Transmission, 122.
 Lucan Tramways, 73.

M

Machinist's and Engineer's Pocket Manual, 250.
 Magnetic Ore Mining Exhibit, 195.
 Magnetic Wind, 88.
 Manganese Dioxide in Lead Accumulators, 19.
 Manufacture and Storage of Acetylene Gas, The, 9.
 May Meeting of Street Car Men in Chicago, 120.
 Mean Horizontal Candle Power, 115.
 Measurement of Insulation Resistance by Alternating Currents, 115.
 Midland Railway's Electric Lighting Plant at Leicester, The, 39.
 Municipal Telephony, 201.
 Municipalities and Electrical Work, 232.

N

National Association of Manufacturers, 25.
 Naval Appropriation Bill, The, 115.
 Necessity is the Mother of Invention, 4.
 NEW COMPANIES INCORPORATED:—
 Pages 12, 60, 92, 108, 124, 140, 156, 172, 188, 204, 220, 236, 252, 268, 284, 300, 316, 332, 348, 364, 380, 396, 412.
 New Electrical Thermometer, A, 362.
 New Postage Stamp Commemorative of the Holding of the Trans-Mississippi Exposition, 3.
 New Technical Institute, A, 201.
 New Electric Incandescent Lamp, 201.
 NOTES FOR INVESTORS:—
 Pages 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240, 256, 272, 288, 304, 320, 336, 352, 368, 384, 400, 416.
 Nottingham Electric Tramways, 233.
 Novel Electric Boat Propeller, A, 4.

O

OBITUARY:—
 Emery, Chas. E., 340.
 Habirshaw, Wm., 74.
 Perry, Nelson W., 177.
 Rhotshamel, J. H., 99.
 Ohio Street Railway Association, 377.
 One-Hundred Mile Transmission Scheme, 243.

P

Partial List of Exhibitors at the Electrical and Kindred Industries Exhibition, 89.

Patent Amendments, 88.
 Patent Office Bill, A, 186.
 Patent Office Behind in its Work, 86.
 Passenger Railways, 46.
 Personal, 89, 105, 212, 227, 233, 361.
 Polyphase Motors, 99.
 Portable Electric Railway, 163.
 Power House for the Naval Academy, 38.
 Practice of Theory, The, 67.
 Practical Work With X-Rays, 56.
 Present Efficiency of Incandescent Lamps, The, 52.
 President Higgins' Address, 35.
 Proposed Increase of Examiners in the U. S. Patent Office, 298.
 Proposals Invited for Electric Elevator, 201.
 Proposals Invited, 68, 137, 169.
 Protecting Power Lines from Lighting, 119.
 Principles of Electric Telegraph, 41.
 Purification of the Electrolyte in Copper Refining, 165.

R

Rand Central Electric Power Plant, The, 7.
 RECENT COMPANY ELECTIONS:—
 Pages 11, 27, 43, 59, 75, 91, 107, 123, 139, 155, 171, 203, 219, 235, 251, 283, 299, 315, 331, 395, 411.
 Reception Committee of the N. E. L. Association, 329.
 Removals, 267.
 Resistance of Silicon, The, 31.
 Revised Partial List of Exhibitors, 212.
 Roentgen on the Roentgen Rays, 292.
 Roentgen Ray Work in English Hospitals, 136.

S

SEARCHLIGHT, UNDER THE:—
 An Easter Souvenir, 211.
 An Electric Organ, 99.
 An Overdone Specialty, 34.
 "A Roast" for a Roaster, 147.
 Bernstein Electric Co., 50.
 Bernstein Failure, The, 66.
 Coffin, Mr., Becoming Aesthetical, 290.
 Corporation for the Consumption of Stockholders, 210.
 Couldn't Start the Road, 67.
 Do They Keep a Buffet There? 114.
 Electric Lighting in Cuba, 243.
 General Electric Capital Impairment Problem, The, 226.
 General Electric's Prosperity, 66.
 How He Satisfied the Brewer, 131.
 Is It Believed? 18.
 Is this Another General Electric Scheme? 354.
 Lamp-lit Look, The, 67.
 Last Application, The, 114.
 Latest Trolley Litigation, The, 211.
 Manhattan Elevated Contract will be but a Drop in the Bucket for the G. E. Co., The, 3.
 New Form of Fuel, A, 99.
 No Faith in the General Electric Co., 98.
 Omitted the Dynamo, 243.
 Power for the Whole World Except Philadelphia, 51.
 Progressive Euchre, 210.
 Stockholders Growing Restless, 51.
 Timely Decision, A, 35.
 Value of Their Contracts, The, 114.
 War on the General Electric, 194.

Westinghouse Inspiration, A., 34.
 Westinghouse Kick, A, 2.
 We Told you So, 242.

Shielded Conductors, 70.
 Shoreditch Destructor Plant, 340.
 Smallest Electric Motor, 88.

SOCIETY NEWS:—

American Institute of Electrical Engineers, 56, 121, 243, 265, 393, 409.
 Canadian Electrical Association, 409.
 Henry Electrical Society, 57, 163, 359, 378.
 Midsummer Meeting of the N. W. E. Association, 35.
 New York Electrical Society, 10, 24, 89, 105, 185, 249, 282, 297, 313, 330, 370.
 National Electric Light Association, 120, 153, 297, 329.
 South African Industrial and Art Exposition, The, 389.
 Species of Cathode Rays, 7.
 Special Prize Offer, 56.
 Stanley Electric Manufacturing Co., 51.
 Standard Diagrams, 153.
 Standard System of Electrical Diagrams, 104, 118, 136.
 Street Railways in Massachusetts, 120.

T

THE NEWS:—
 Pages 10, 25, 42, 57, 74, 90, 106, 121, 154, 170, 186, 202, 218, 234, 250, 266, 282, 298, 313, 330, 346, 362, 379, 394, 410.
 Teaching Through the Phonograph, 398.
 Telegraphic Tournament, The, 137.
 Telegraph Rates from Europe to Jamaica, 41.
 Telephone Lines and Thunderstorms, 163.
 Telephone Transformer, 8.
 Temperature of Incandescent Lamps, The, 345.
 Temperature Coefficients of Magnets, 232.
 Tests on the Englewood and Chicago Electric Storage Battery Road, 87.
 Theses Competitions for Students, 56.
 Third-Rail Line in Germany, 7.
 Transformation of X-Rays by Metals, 4.
 Tramway Power from Lighting Stations—What is a Fair Price to Charge? 40.
 Trans-Mississippi Exposition, The, 313, 340, 386.
 Trial Accumulator Car, A, 19.
 Triumph of Science, A, 312.
 Trolley Decision, The, 233.
 Tungsten Steel for Magnets, 99.
 Two Hundred Mile Electric Railway, 169.
 Twenty-first Convention of the N. E. L. Association, 339.

U

Underground Electric Railway for London, 41.

V

Volunteer Engineers, The, 410.

W

Waking Up, 4.
 Washington Notes, 35.
 Western Telephone Construction Co.—Officers Elected at the Annual Meeting, 185.

Y

Year's Work in the Patent Office, 164.

ELECTRICITY.

Vol. XIV.

NEW YORK, JANUARY 12, 1898.

No. 1

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**

CONTENTS.

Editorial Notes,	12
A Prize Offer,	
Novel Electric Railways,	
Telephone Charges,	
Proposed Trolley for Chicago River,	
Under the Searchlight,	2
A Westinghouse Kick,	
The Manhattan Elevated Contract,	
A New Postage Stamp Commemorative of the Holding of the Trans Mississippi Exposition,	3
Cheap Telephone Lines,	3
Electric Tramways in New York,	4
A Novel Electric Boat Propeller,	4
The Transformation of X-Rays by Metals,	4
A Telephone Transformer,	4
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XII—Electro-Galvanizing and the Electrolytic Extraction of Zinc from its Ores By J.B.C. Kershaw, F.I.C.,	5
Clontarf Electric Tramway,	6
A Third Rail Line in Germany,	7
The Central Electric Power Plant,	7
Species of Cathode Rays,	7
Motion of the Ether,	8
The Electrical Show,	8
Electrical Exports,	8
Book Reviews,	9
Canadian Notes,	9
Legal Notes,	9
American Association of Inventors and Manufacturers,	10
New York Electrical Society,	10
General News,	10
Notes from a Correspondent,	10
Personal and Miscellaneous,	
Recent Company Elections,	11
Commercial Paragraphs,	11
Incorporations,	11
Telephone and Telegraph,	12
Electrical Securities—Stocks, Bonds, Etc.,	12
Notes for Investors,	16

EDITORIAL NOTES.

A Prize Offer.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to **ELECTRICITY**.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of **ELECTRICITY**, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of **ELECTRICITY** duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of **ELECTRICITY**, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

Novel Electric Railways.

If all the reports we hear are true, the coming summer should see the Klondike well equipped with transportation facilities. Several companies have already been organized and others are about to be formed for the purpose of constructing electric railways into that country.

In an editorial which appeared in **ELECTRICITY** some time ago, we suggested as the most suitable form of railway a single rail electric road with the rail some distance above the surface of the ground. A company is now being formed in Seattle, so we understand, and plans have been prepared for an electric road which it proposes to build over the Skaguay trail and which is to be erected after the manner we suggested. The track is to consist of 12 by 12 inch posts six feet high and fourteen feet apart, on top of which will be strung two timbers 6 by 12 inches, and twenty-eight feet long, on which a 30 lb. steel rail is to be placed. The cars it is proposed to use are to be fifteen feet long and four feet wide, having but two heavy wheels, each of the latter being equipped with a 15 H.P. motor. When in operation two cars will be joined together by heavy overhead beams and run one on either side of the rail, making practically one car. The bottom of the cars will be two feet above the surface of the ground, which will enable them, so it is thought, to successfully plough their way through any ordinary snow drift. It is estimated that 1,000 feet of track a day can be built in Alaska at a cost not exceeding \$5,000. Although this would make a road cost \$26,400 per mile, considerably more than the ordinary trolley, when the rugged nature of the country is taken into consideration this amount does not seem excessive. A trolley of the above description would appear to be admirably adapted to the needs of such a country, but it would seem as though it might be further improved upon by placing the rail at a greater elevation. This might increase the first cost slightly, but it would effect a great saving in wear and tear, and would allow of greater speed being made.

Another company composed of American capitalists propose overcoming the difficulties of the Dyea trail in a rather novel manner, by means of an aerial railway. Steel columns thirteen feet in height will be erected one hundred feet apart, from the top of which wire ropes will be suspended which will constitute the track.

Specially designed cars will be hung from this track by means of steel bars, each carrying two grooved wheels running on the cable. A lower cable attached to the vertical bar of the car will be used for propulsion, which will be accomplished by means of a stationary motor. The promoters' idea in building this railway, which will be but seven and one-half miles long, is to afford a speedy and easy method of transportation over an exceedingly rough portion of the route.

The unusual difficulties attending the construction and maintenance of an electric road in that part of Alaska require the adoption of extraordinary methods, and the next few months will therefore probably bring forth a number of unique systems of electrical propulsion.

* * *

Telephone Charges.

The New York *Herald* has recently devoted considerable of its space to discussing the existing telephone rates in this city and comparing them with similar charges made abroad and in other cities in this country. As is well known, in New York a subscriber has his choice between what is known as the flat rate system, which costs \$240 a year and which means unlimited service, and the toll system, which limits him to six hundred conversations a year for which he is supposed to pay \$90. Chicago has telephone rates that vary from \$175 a year for unlimited service to \$58.40 a year for a limited service. In Philadelphia the charges for unlimited service are even lower than in Chicago, and a business house can have an instrument installed and use it as often as required for \$160 a year. This same service in Boston costs \$180.

New York City has all along had the reputation of being the stronghold of the Bell Company, and judging from the charges that subscribers are obliged to pay, this would certainly seem to be the case. Now the question naturally arises, why are the telephone rates in this city so much higher than in other large communities of the United States? The daily previously referred to endeavors to solve this problem, and publishes an interview with Mr. U. N. Bethell, general manager of the New York Telephone Company. To the question as to whether it would not be possible to radically reduce the present rates and still leave a profit, Mr. Bethell is quoted as follows:

"You must take into consideration our very heavy expenses, such as the subway charges. It costs us about \$800 a mile. Then, our rents are much higher than in other cities. Why, we pay \$10,000 for one little office. You don't find such rents even in London or Paris. Again, we have to pay much higher wages than in European cities. In short, nearly all of our expenses are heavier than abroad. The same thing holds with the larger cities of this country."

In the above answer the whole point of the inquiry seems carefully evaded.

It is unquestionably true that foreign rates would naturally be lower than the average rates in this country, principally on account of the labor item, but this argument no longer holds good as regards Boston, Philadelphia and Chicago. The rents in New York are undoubtedly higher than in the latter cities, but assuming similar rates in all these cities, this difference in rent should be more than made up by the difference in the number of subscribers. There is no gainsaying the fact, however, that the expenses of a company such as the New York Telephone Company are heavier in a city like New York than in the other municipalities mentioned, but there can be scarcely any doubt that the present telephone rates could be materially reduced and still leave the company a fair profit. So long as the general public are willing to pay high rates and make no effort to have them reduced, so long will they remain high. The Bell monopoly has always been run by a set of enterprising business men who are not in the habit of allowing chances to make money slip by them.

Regarding the question of high rates the *Herald* says:

"Other directors of the New York Telephone Company refused to discuss the matter. According to the reports of State investigating committees the company is making very large profits, the amount of which, however, is not published."

There is scarcely any doubt but what their profits are large. With 21,000 subscribers in New York,

which this company acknowledge they have—5,000 paying \$240 a year and the other 16,000 who have limited service paying \$90 a year—the total gross revenue would amount to \$2,640,000. This, of course, does not include the amounts taken in each month from the subscribers who have limited service and who frequently call up more times than their rate allows. If the operating expenses of the local company are two-thirds of the total gross receipts, and it is rather difficult to see how they can be much more, there would still be a balance of almost \$1,000,000 left. That certainly looks as if the existing rates could be further reduced and still leave a fair profit.

The Paris edition of the *Herald* recently mentioned a circumstance which is often lost sight of and which is sometimes a source of expense to a corporation. It refers to this matter as follows:

"All the companies in New York are more or less liable to have to pay out money to keep 'square' with the 'powers that be,' and most business men, used to large enterprises of the kind, would consider that it would be disastrous to a company to have the telephone system taken over by the Government so long as the 'spoils' system is so much in vogue. Hence, for an efficient telephone service, private companies are considered in America as more satisfactory."

In Paris the telephone system is controlled by the Government, and although such an arrangement works fairly well there and in Europe generally, and usually ensures low rates, it can scarcely be recommended for this country. The rate in Paris for unlimited service is but \$40 a year, this low charge probably being accounted for by three circumstances which do not exist in New York. First, the cost of labor, as is well known, is much lower in France than in this country; secondly, no expense is incurred for subways, as the cables are placed in the sewers; and thirdly, there is no great desire on the part of the Government to make money, as would be the case were the system operated by an independent company. As we have already stated, however, it is hardly fair to compare the rates in New York with those abroad, but what we can base our comparisons on are the existing rates in other large cities of the United States. In comparing these charges we find that the public in New York are paying 25 per cent. more for telephone service than the people of Boston, who apparently have the next highest rates. This is scarcely just, for although the cost of operation may be slightly higher in this city, there is no such discrepancy as the difference in charges would lead people to believe. When the general public awake to the fact that they are paying exorbitant charges and demand a reduction it will be forthcoming, and no one need be afraid that this would result in a receivership for the telephone company.

* * *

Proposed Trolley for Chicago River.

Mr. A. S. Hibbard, general manager of the Chicago Telephone Company, recently suggested that the Chicago river be navigated by electric lighters. His idea would seem to be to have an outside harbor with almost limitless dockage and use the river exclusively for the trolley boats, the purpose of which would be the lightering of big freighters in the outer harbor and the distribution of cargoes almost at the merchant's door. Mr. Hibbard thinks there is ample room for operating four parallel trolley lines, and that power could be obtained very economically from either the drainage canal at Lockport or from the large electric plants of the city. In the *Milwaukee Sentinel* Mr. Hibbard is quoted as having made the following statement regarding these river trolleys:

"This is no dream, no idle fancy of a visionary, but a plan that will appeal to the practical, common sense of any competent electrical engineer. Chicago has reached a point in her growth where no small

half-way measures should be considered. We must plan in keeping with our present standing and great possibilities. I would summons electricity—that wizard of the century—to help us banish many of our greatest evils. No one will question that our present harbor facilities are wholly inadequate; that swing bridges are an hourly torture to our nerves and patience; that the tunnels are a back number, and that our unsightly river is the butt for a nation's ridicule. The drainage trustees promise to make the river quick running, clear and wholesome. I would cover its surface with busy commerce and by means that would add no taint to the air or discolor the limpid water."

This plan, as suggested, necessitates the use of steam tugs to take these electric lighters from the mouth of the river where the trolley wires terminate to the loaded vessels in the harbor as well as to bring them back. Moreover, with four lines of wire running up the river, the boats using the inside wires might find difficulty in making their docks, as doing so would necessitate their letting go of the overhead trolley. This could be remedied, and it would probably be found necessary to do so by placing storage batteries on each of the lighters which could be charged from the overhead conductor. The adding of storage batteries, although it would increase the cost, would also enable a lighter on reaching the mouth of the river to dispense with the services of a tug.

Undoubtedly the advantages of such a scheme would be its cleanliness, due to the absence of smoke and soot. As regards the financial aspect, it is questionable whether this arrangement would be any more economical than either gasoline or naphtha. Were electricity used, three separate units would be required, whereas but one would be necessary were either of the other two motive powers adopted.

Whenever the water of the Chicago river flows toward the Mississippi, as it presumably will when the drainage canal is completed, it would be far preferable to use the river as Mr. Hibbard suggests rather than to cover it with iron planking and asphalt with a view to making a huge culvert of it as Mr. Yerkes has suggested.

Under the Searchlight.

Notes and Comments on Various Topics.

A Westinghouse Kick.

(From the Boston Herald.)

The following account of the rumored difference between the General Electric and Westinghouse companies is given in New York: According to the terms of the agreement, the General Electric Company was to receive 65 per cent. and the Westinghouse 35 per cent. of the business. Should either company do a greater percentage than the amount stipulated, it agreed to pay over to the other a certain percentage of the revenue derived therefrom. The General Electric Company ran ahead of its proportion. Westinghouse brought the matter to the attention of the directors of the two companies, a number of conferences were held, and an agreement was reached satisfactory to both parties and relations are harmonious.

It must have been astounding as well as irritating to Mr. Westinghouse to be obliged to hold several conferences in order to decide a matter that was plainly set forth in the bond between the companies, and he will hardly be able to promptly rid his mind of the fact that the attempt was made to overreach him. But he should have known that he is unable to cope with Charles A. Coffin in such affairs. He will find that future conferences for the settlement of questions between the two companies will be more and more prolonged and less and less satisfactory until the end is reached. What the end will be we will not venture to predict, but there is a fable about the wolf and the lamb that suggests the probability.

* * *

ACCORDING to the public press the temperance circles of Chicago have been of late terribly stirred up, not to say overwhelmed, by the discovery that

the electric light plant of the building they occupy actually furnishes light to a saloon. We fail to see why the temperance society should object to "letting their light so shine before men."

* * *

The Manhattan Elevated Contract Will Be But a Drop in the Bucket for the General Electric Company.

Regarding the recent decision to equip the elevated system with electricity, Manager W. J. Fransioli made the statement that a fair estimate of the total average power needed to operate the elevated railroad system was about 75,000 horse-power. With a view to showing how absurd it is for the General Electric Company to rely on this contract to help them to a dividend-earning basis (provided of course that that organization gets the whole contract, without the Westinghouse Company coming in for its share), we have made the following calculation. Assuming that the 75,000 HP. costs \$10 per HP. for electrical generators and appliances and \$10 per HP. for motors, etc., the total contract for this electrical apparatus would amount to \$1,500,000.

The amount of business required by the General Electric Company to pay dividends on its present capitalization is about \$45,000,000 per annum. Its present business amounts to about \$12,000,000 per annum. There is therefore a deficit in business at present to earn dividends of \$33,000,000 per annum. As the Manhattan contract amounts only to \$1,500,000, it would be necessary for the General Electric Company to get nearly two such contracts a month to earn dividends on its present capitalization. And yet it is trying to cheer up its drooping stockholders with vague intimations of millions of profit.

* * *

CHICAGO is said to have started what is known as the trolley church collection boxes. A wire is stretched from pew to pew upon which little carriages are strung. This contrivance is operated by electricity, and the minister by merely touching a button located in front of him on the top of the pulpit releases these little cars simultaneously all over the church. The great advantage claimed for the trolley collection boxes is that it keeps the amount of each contribution a secret from those sitting in the vicinity. We hardly think this will prove an advantage in fashionable churches, for without the possibility of one's neighbor seeing the amount of a donation, the total collection would probably be considerably smaller than usual.

* * *

It now seems that Emperor William of Germany, not content with having tried his hand at painting, poetry, oratory and numerous other things, is about to enter the field of electrical science. The *London Electrical Review* says: "He will lay aside for the time being his brush and palette, will hold the Muses in abeyance, will stifle his Rozinante, forget the sound of martial music, and in a serious manner sit down to devise an electric tramway system such as no man ever invented before him. We learn that it has been left to him to decide what system of electric traction shall be adopted for Berlin; but it is highly probable, we are told, that he will not select either of the systems already propounded, but will, if he has time, invent a new one. The principal difficulty seems to be the want of time; but if we may, without being guilty of treason, suggest anything, we should think that a whole army of poets, artists, prophets and admirals might be found ready to bow the knee and relieve him of his other duties for the time being, so that his entire genius could be concentrated upon a matter which has to a certain extent baffled electrical engineers of life-long experience of all nations and tongues up to the present time. A capital idea would be for the Emperor to purchase for a few marks some patent or other from one of his starving subjects, and whether he understands it or not, to give it his approval. Then, whether it is good or bad, who in Germany will dare to criticize

it? It must be favorably received by the press and the public or the results—! We are tempted to wonder whether the Emperor's system will be a trolley or conduit; or it may be, he will bring out a new accumulator—or, perhaps, even a primary battery!"

* * *

CHAS. G. ARMSTRONG refers to electrical journalism in the *Chicago Record* as follows: "I think all engaged in electrical work will agree with me that the most potent factor in the development of this limitless agent has been the high character, the untiring energy, exhibited by our various electrical journals. One who has watched their struggles, ever endeavoring to eliminate the chicanery, to expose any attempt of unscrupulous inventors to rob the over-confident public, holding up the hands of the faithful and honest worker however humble he might be, ever ready to enlighten the public of the to them marvelous and unreal force, avoiding the spectacular and theatrical, cautioning the too ready investor, ever encouraging the legitimate enterprise—thus have the electrical journals done as much as the inventors themselves to perfect, to ripen, as it were, into usefulness this vast industry. I have often wondered what the electrical fraternity would have done had it not been for the untiring enterprise of the electrical journals. Text books have often been valueless. The science has grown so rapidly that before a text book could be written and placed on the market the subject would be trite and the theories outgrown. The machines described therein would no longer have been used, new ones having been devised and placed in their stead. But meantime our faithful journals, week by week and month by month, have kept pace with the rapid trend of affairs." Mr. Charles G. Armstrong must certainly have had ELECTRICITY specifically in mind when he wrote the above; for we are unquestionably the only electrical journal that can conscientiously assert that it has always endeavored to guard the interest of the investor and protect the trade by showing up unscrupulous undertakings. We have always fought to place the electrical industry on a good, honest basis, and we will continue doing so until our efforts are crowned with success.

A New Postage Stamp Commemorative of the Holding of the Trans-Mississippi Exposition.

For the third time in the history of the nation, in recognition of the importance of a brilliant enterprise, Postmaster General Gary has decided to order a series of special postage stamps commemorative of the holding of the Trans-Mississippi and International Exposition at Omaha in 1898. The stamps will be issued in denominations of 1-cent, 2-cent, 5-cent, 10-cent and \$1, making it possible for the public to use these stamps on all outgoing foreign as well as domestic mail matter and packets of merchandise. In the United States there are 70,000 post-offices, so that the widespread circulation of these special stamps, suggestive of the Trans-Mississippi and International Exposition, will be readily attained. The issue lends the Exposition the prestige of Government recognition and support.

In issuing these special stamps it is not designed by the Postmaster General to withdraw from sale the current series as was the case during the World's Fair. The series of special stamps for the Trans-Mississippi and International Exposition will be supplied to any office in the United States, and every postmaster will find an active demand for them from the start, not only by stamp collectors, but by hundreds of thousands of people who will prefer them during the Exposition period in place of the regular series.

Third Assistant Postmaster General Merritt invites suggestions of scenes for use on the stamps, it being the desire of the Post-Office authorities to give the Trans-Mississippi and International Exposition the handsomest set of stamps ever issued to commemorate an Exposition.

CHEAP TELEPHONE LINES.

The following article, which appears in the *New South Wales Railway Budget*, is interesting as showing how poor the insulation of a telephone line must be before the instruments are useless. It must be remembered, however, that the climate is the ruling factor in such lines as described below, and that what may be possible in Australia may be wholly impracticable here.

The Railway Commissioners have a great penchant for adopting inventions where there is economy to be gained, and an interesting instance of the adoption of modern ideas in a minor way has recently taken place in connection with telephone communication.

At the present time, the common idea of the telephone is that of the ordinary telegraph poles, with wires stretching overhead; but the commissioners have recently experimented with telephones, with wires in the first place between the rails, and in the other along the railway fences.

The first of the two instances referred to is the practically poleless line which has been laid from Nyngan Junction to Hermidale, on the Cobar branch, a distance of 28 miles.

Starting from Nyngan, there is about a mile of telephone line to Nyngan Junction, whence the circuit is continued by means of a No. 6 iron fencing wire in the center of the track. This wire rests at intervals in a groove across the top of a hardwood block measuring 4 in. long by 2 in. high by 1½ in. wide; a cap of the same wood holds the wire down, and two 4 in. iron wire nails through cap and block into the sleeper secure the whole so firmly that it needs the deliberate use of very heavy tools to loosen it. The blocks, which were designed with a view to cheap production, were made in the interlocking workshops, and were dipped in a preparation of Stockholm tar, resin, etc., to increase their durability and insulating properties. The maximum distance between any two blocks is about 100 ft., but the spacing was often regulated by the curvature of the line and the weight of the ballast. In fact, contact with the ballast was in some instances unavoidable; and although the clean broken porphyry will constitute an excellent insulator in all but the worst of wet weather, it has been considered advisable to arrange for the ballast to be lowered in these places as opportunity offers. The wire was erected as high as was deemed wise in consideration of the line being unfenced and the presence of cattle on the route. At crossings of roads or beaten tracks the wire is brought up to a pole on each side and connected by an overhead hard-drawn copper wire at the regulation height.

The telephone at Hermidale makes earth by means of two copper plates placed vertically in the ground, and presenting a total of 48 square feet of contact surface, while that of Nyngan utilizes the water-supply pipes. Having made every provision to secure a low circuit resistance, the comparatively poor insulation resistance is further taken into account by specially winding the coils of the generators for a heavier current than usual, so that considerable current may be lost along the line and yet sufficient remain to ring the distant bell. Up to the present the line has given entire satisfaction. Observations will be taken of its behavior under all variations of temperature and weather, and if the results warrant the expectation of sufficient reliability under local conditions for railway purposes, it is the intention of the commissioners to extend the line on to Cobar in a similar manner.

Of equal interest is the recent use by the commissioners of the wire of the fence for telephonic purposes between Walla Walla and Corowa. This is a means of communication that may, however, be largely taken advantage of in the future for railway and other purposes. One naturally begins to wonder whether the rails themselves might not under certain circumstances be utilized by means of a suitable telephone, and whether indeed, what with return currents on the rails of the fast-increasing electric

railways and tramways, the use of gas and water mains for telegraphic and telephonic requirements, we are not rapidly approaching the time when it will be impossible to lay down a hundred yards of metal for any object whatever that will not be com- placently appropriated by electrical engineers for the purpose of conveying current. In fact, they are already treading on one another's toes, and it has taken some very weighty legal proceedings to decide which had the better right to the use of that for which neither had paid.—*Electrical Engineer, London.*

Electric Tramways in Cork.

The electric tramways of the city of Cork consist of about 11 miles of track. The gauge is 3 ft., which is the same as that of other lines running out of the city. The rails weigh about 83 lbs. per yard. The power station buildings about to be equipped for electrically working the line will comprise an engine room, boiler room, battery room, car-shed and repair shop, covering an area of about 12,000 sq. ft. In the boiler room there will be three Babcock & Wilcox boilers, each of 2,531 sq. ft. heating surface, and capable of evaporating 8,000 lbs. of water per hour. There will also be an auxiliary heater, combined hot-well and filter tank, and a duplicate set of filters. The chimney stack will be of steel, 7 ft. internal diameter, and 130 ft. high. The engine room will contain three McIntosh and Seymour side-crank tandem compound engines directly connected to 200 kilowatt generators, running at 150 revolutions. The engines will be run condensing, two Wheeler, Admiralty type, standard surface condensers, each having a capacity of 12,000 lbs. steam per hour, being erected on the engine room floor. Condensing water will be taken from the river, about 500 ft. distant. The battery room will contain 256 Tudor cells capable of discharging at 110 amperes for seven hours. A booster of suitable capacity will also be supplied for regulating charge of cell, the booster being in the engine room. The switchboard will consist of a combination of lighting and railway panels, the same machine being interchangeable for railway and lighting service. The lighting distribution using 220-volt lamps will be on the three-wire system, at 440 volts across the outers. The battery and regulators will be connected in the neutral, so as to control the balancing current. The dayload will be taken from the railway generators by a motor generator consisting of a motor and two 220-volt generators on the same bed-plate. The generators also act as regulators when a single 440-volt generator is supplying the lighting current direct. There will be 18 double-decked cars, seating 44 passengers, mounted upon single Peckham trucks with double motor equipments and series-parallel controllers. The line construction will consist of iron poles with brackets, side brackets being used for single track, and double brackets with center poles for double track. There will be 94 arc lamps mounted on the top of the poles, constant potential arc lamps being used, connected to the underground network of lighting mains.

An Electrically-Driven Tea Factory.

The *Indian and Eastern Engineer* states that the British Darjeeling Tea Company is the first tea factory to introduce electric power for driving their plant. The Thurbo tea estate, which is owned by the company, covers over 3,000 acres, extending from the Mechi river (one of the Nepal boundaries) to the Rungbong river. The factory is situated at one mile from the latter river, at an elevation of 4,000 ft. The water, taken from the Rungbong river, is led by a substantial waterway of masonry to a point where a fall of 56 ft. is obtained; from this point 16 in. steel pipes convey the water to a 40 H.P. Jonval turbine. To this turbine is connected, by belt and pulley, a Mather and Platt "Manchester" dynamo capable of generating 70 amperes at 320 volts. The current is transmitted by overhead copper wires to the factory, where it drives a Manchester motor

capable of developing 24 B.H.P. The machinery driven comprises two tea driers, two tea-leaf rollers, one tea packer, two tea sifters, and one tea cutter. The electric lighting is effected from the same mains. Our Indian contemporary points out that owing to the stringency of the Forest Department, firewood is difficult to obtain in the Darjeeling district, and coal has to be brought from afar and is dear.

A Novel Electric Boat Propeller.

We had an opportunity lately, says a London journal, of seeing a new development in the design of electrically-propelled pleasure craft, which has been given the name of the "Nymph." Briefly, the "Nymph" is an attachment to an ordinary pleasure boat sailing ahead of it but rigidly connected to it, the boat containing the accumulator cells and the switch-gear by which is controlled the motor in the body of the swan-shaped tug. The craft is guided or steered by two reins attached to the head of the "swan," and these reins actuate by gear the ordinary rudder. A regulator situated close to the right hand of the driver enables him to control the speed of the motor and propeller in the "swan," and to go at full or half speed, ahead or astern. There are 16 chloride cells of 17 plates each, and these, for starting and low speeds, are connected to the motor in two parallels of 8 cells each, all the cells being used in series for full speed. The total electrical capacity of the battery is about 300 ampere hours, and this is equal to propelling the boat at a speed of eight miles an hour for six hours, or a total distance of about 50 miles, with six people on board. No resistances are used, and neither the field nor the armature is divided up in any way to regulate the speed. The vibration of the boat is perceptibly less than in one containing the motor. Although the arrangement lends itself to graceful design, there is probably considerable loss of efficiency as compared with the usual stern propeller. The inventor of the "Nymph" is Mr. Bowick.

The Transformation of X-Rays by Metals.

An article by M. G. Sagnac, with the above title, appears in the *Comptes Rendus* of December 6. When Roentgen rays strike a metal plate, even when this is formed by a mercury bath and the angles of incidence is 75 degrees, they are diffused without experiencing any appreciable regular reflection. M. Sagnac has been investigating the characteristic of these secondary rays, and has arrived at the following conclusions: The secondary rays are propagated in a straight line, and do not experience any sensible diffraction or refraction. They are not reflected either, and if they themselves impinge on another mirror they are diffused in the same way as X-rays; in discharging electrified bodies they also act similarly to X-rays. The secondary rays from different metals can be distinguished by their different transmission through the same substance.

Thus, for instance, the rays from copper are transmitted by black paper to a greater extent than the rays from zinc and tin. Rays from lead are absorbed more by the atmosphere than rays from zinc and copper. It is also noteworthy that various bodies are more opaque to the secondary rays than to the incident rays which generate them. Thus if a sheet of aluminum 0.2 mm. thick be placed between the Crookes tube and the radiating metal sheet, the photographic or discharging action of the secondary rays is reduced but slightly—say, by one-third. If, on the other hand, the aluminum sheet be placed between the secondary rays and the photographic plate or electroscope, their action is considerably diminished.

Finally, M. Sagnac is of opinion that the secondary rays which metals emit under the influence of X-rays are new rays neighboring on X-rays, and that they must doubtless be placed in a similar position to the rays issuing from a Crookes tube as that taken by the radiation of a luminescent body with regard to the rays of shorter wave-length which have produced it.

A Telephone Transformer.

The researches recently made by Dr. Reding with regard to the efficiency of transformers included tests of a telephone translator, or transformer, designed and used by the Warburg Government Telegraph Department. This instrument has lately been considerably altered. It consists of a number of sheet iron stampings 1.2 mm. thick. These are held together by insulated bolts having nuts at each end for clamping the plates together. The upper and open side of the magnetic circuit is closed by a strong iron plate held on by bolts passing into the base of the instrument. The two coils now used are each wound with 1,600 turns of .25 cm. diameter copper wire, having about 200 ohms resistance. In the first apparatus only about 1,200 turns of a heavier wire having a total resistance of 100 ohms were employed.

The present type is said to have the advantage over the old circular type that the coils are easily replaceable in case of damage by lightning, as the iron plate at the top only has to be removed to give access to the windings. There are about 40 of these transformers now in use, and three years' experience has proved that they are reliable and most useful. In the former instruments the iron plates were insulated from each other by paper, but now the oxidized surface of the plates on a coating of shellac varnish is found to be sufficient. The above description is taken from the *Elektrotechnische Zeitschrift*. The most noticeable feature in the transformer seems to us to be that an unlaminated iron plate is used to close the magnetic circuit. From the nature of the vibration in a telephonic circuit we believe that this plate is absolutely useless and perhaps harmful. It would be better to leave the magnetic circuit open, and to hold the coils in place by a wood top.—*Electrical Engineer, London.*

The First French Electric Railway.

The *Revue de l'Electricite* states that the construction of the first electric railway in France is to be commenced immediately by the Paris, Lyons & Mediterranean Company. The line will connect Fayet and Chamounix. The carriages will be automotor, and the current will be taken from a lateral rail by means of metallic brushes. The same system has been adopted on the Saleve railway. The motive force will be derived from two stations which elevate the waters of the Arve to a height of 240 feet. The line will have a length of over 11 miles, and will cross the River Arve five times.

Necessity is the Mother of Invention.

The *Electrical Engineer* of London says: We have heard of electrical engineers taking upon themselves the responsibilities of volunteer soldiers, and now we hear of soldiers taking upon themselves, although only in a minor degree, some of the responsibilities of electrical engineers. A corps of 300 men under the British South Africa Company has, we are informed, during the past few months introduced and erected over 200 miles of telephone wires in Matabeleland, in addition to their regular police duties of garrisoning and patrolling the country.

Waking Up.

In Hang-Chow-Foo, the capital of Che-Kiang, and in Han-Kow, on the Upper Yangtse, Chinese syndicates have been formed to erect electric lighting works. Even in Chang Sha, the capital of the Province Hunan, which is noted for its bitter feeling against foreigners, electricity works have already been put in operation for the lighting of private houses.

The Gas Commission of New York City went out of existence on the first day of the present month. Under the provisions of the new charter its work devolves upon the Commissioner of the Department of Public Buildings, Lighting and Supplies, as do the duties of the Board of Electrical Control.

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XII.—Electro-Galvanizing and the Electrolytic Extraction of Zinc from its Ores.

Introduction.—Electrolysis has been applied to the separation of zinc from solutions of its soluble salts for two distinct purposes. In the one case the aim of the inventor has been to extract the zinc from its ore, and the physical characteristics of the deposit of zinc have been of secondary importance. In the other case, the protective coating of surfaces of iron or other metal with a thin, smooth and unbroken layer of metallic zinc has been the object in view, and the character of the deposit has thus been of chief importance in the process. There are several electrolytic processes now being worked upon an industrial scale of operations with considerable success in England and Germany for coating articles of iron with a protective layer of zinc, and this industry may be regarded as an established one. With regard to the electrolytic extraction of zinc from its ores, the position is less satisfactory, and although several processes are now working upon a large scale in England, in Germany and in New South Wales, it is still doubtful whether the zinc obtained in this way can compete with the zinc obtained from other ores by the older and simpler distillation process.

Electro-Galvanizing.—Three electro-galvanizing processes, patented by Cowper-Coles, Alexander, and Richter, are being worked in Europe to-day. These resemble one another in general principles, and only differ in subordinate details of the process of the plant. A solution of a soluble salt of zinc is electrolyzed, using the article which requires the protective coating of zinc as cathode. This of course receives the deposit of metal, and if all the necessary conditions have been observed, a smooth, bright, continuous coating of metallic zinc will be obtained. One of the chief difficulties in obtaining a satisfactory deposit of zinc has been caused by the tendency of the metal to separate in spongy form at the cathode. Many investigators have worked at this problem and have recommended various procedures for preventing the formation of the zinc sponge. Although Siemens & Halske have attributed this form of zinc to the production of a zinc hydride at the cathode, and have therefore recommended the use of oxidizing agents, the greater weight of opinion is on the side of those who consider it is due to the presence of zinc oxide, and who advise the use of reducing agents at the cathode, or of moderately acid solutions.* Cowper-Coles has shown however that if the acidity of the solution exceeds a certain degree spongy zinc is also formed,† and it is thus necessary to pay careful attention to the acidity of the bath in order to obtain satisfactory results. The Cowper-Coles process, according to the patent specification, consists in the use of an electrolyte containing 40 oz. zinc sulphate and 5 oz. ferrous sulphate per gallon of water with anodes of lead. An EMF. of between 3 and 5 volts at the terminals of the electrodes is used, and a current density of about 15 amperes per square foot of cathode surface area. The electrolyte is renewed by use of zinc dust in a vessel outside the depositing cell. Further details of this process will be found in the article already alluded to. Messrs. Mawdsley Sons & Field, London, Messrs. Watson, Laidlaw & Co., Glasgow, Messrs. Tate & Sons of London, and Messrs. Laird Bros. of Birkenhead are using this process for galvanizing various parts of machinery, ships' hulls and sugar-boiling apparatus.

The Alexander process is used by the firm of Seelhorst & Weiner at Rothenfelde in Germany. It differs somewhat from the others in the nature of the coating, which is not one of pure zinc, but consists of an alloy of zinc with aluminum or magnesium. A

few details concerning this process and many facts concerning the subject of electro-galvanizing generally will be found in a paper read by O. Vogel in 1895 before one of the German industrial societies.* Richter's process is worked at Witkowitz in Bohemia and differs little from that of Cowper-Coles. A detailed description of it is contained in a pamphlet published by Richter in Leipzig in 1895 and entitled "Die Galvanische Verzinkung des Eisens." A summarized version of the facts contained in this pamphlet is given in an article in "Stahl u. Eisen," to which readers desiring to know more of this process are referred.†

In all these processes great attention and care is required in preparing the articles for the electrolytic bath. A preliminary boiling in a caustic alkali solution, followed by a lengthy pickling treatment in a weak vitriol solution, is in every case requisite, and Seelhorst in the discussion which followed the reading of Vogel's paper on electro-galvanizing (l.c.) recommended the use of the sand-blast. After the object has been thoroughly cleansed from grease and rust, it should be placed in water freed from air by boiling or in water containing a little ammonia as advised by Richter, until the bath is ready to receive it; and it should on no account be touched with the hands after it has arrived at this stage of its preparation. The adaptation of the form of the anode to that of the object to be coated is another point requiring attention, since it is only when the distances between all parts of the anode and cathode are approximately equal that an even coating will be obtained. As regards the costs of this process the statements are conflicting, and it would appear to be probable that for large objects the electrolytic galvanizing process is more expensive than the older dipping method. But for small articles the difference in cost is much less, and the electrolytic process has the advantage in the command obtained over the thickness of the coating, which can be made either slight or great at will. When the necessary conditions for the production of a good coating of metallic zinc have been complied with, the adherence between the zinc and iron or other metal is all that could be desired. Some details of tests made with electro-galvanized tubes will be found in the article by Cowper-Coles already named.

Electrolytic Extraction of Zinc from its Ores.—There are four processes now at work on a fairly large scale of operations, having for their object the extraction of zinc from its ores. The general principles of these are the same in every case. The ore is roasted, crushed, and leached with acid or salt solutions which dissolve out the zinc and leave the other metals behind. This solution is then electrolyzed, the zinc is deposited at the cathode, and the exhausted effluent is returned to the leaching vats in order to be renewed by passing through a fresh charge of the prepared ore.

The Ashcroft Process is the process which has received trial upon the largest scale. This process is protected by British patents No. 13,850 of 1894, and Nos. 13,534, 14,783 of 1895, and was designed for treatment of the refractory lead zinc ores of the famous Broken Hill Mine, New South Wales. This ore contains 30 per cent. each of lead and zinc as sulphides, with 25 to 30 oz. silver per ton; the sulphides are so intimately mixed that their separation by concentrating machinery is impossible.

The ore is ground and roasted, and is then leached in suitable vats with a solution containing per. salts of iron and salts of zinc. The iron is precipitated as ferrous hydrate by the action of the zinc oxide of the ore, while the latter passes into solution as sulphate or chloride. The iron remains partly in the leaching vats with the lead and silver and partly separates on heating the effluent. The residue is smelted for the two latter metals in the usual manner. The solution from the leaching vats, which must be quite free from iron, is then passed through two sets of cathode

chambers, and one-third of its contents of zinc is obtained as metal deposit on the cathodes. It is now passed through the two sets of anode chambers of the same depositing vats, in the first of which iron anodes and in the second of which carbon anodes are employed. Solution of the anode with formation of ferrous sulphate occurs in the former series, and oxidation of this to the ferric state in the latter. The effluent from the double series of vats is then ready for use again in the leaching vats. This process was operated upon a fairly large scale of operations at Grays in Essex in 1895, and it then passed into the hands of the "The Sulphide Corporation" which, with a nominal capital of \$5,280,000, has purchased mining rights on the Broken Hill estate in New South Wales, and has erected concentrating machinery at the Mines, and an extraction plant based upon the Ashcroft procedure at Newcastle in the same country.

The erection of the large electrolytic plant at the latter place was commenced in March, 1896, and in March, 1897, a portion of it was put into operation. In a run of 4 months' duration 150 tons electrolytic zinc were produced, but unfortunately the economical results have been less favorable than was anticipated, and the directors have decided that if a second run now in progress does not yield more favorable results the electrolytic works must be shut down. The weak features of the process are the necessity for the removal of the whole of the iron from the solution before the zinc can be successfully deposited from it in the cathode chambers of the electrolytic vats, and the necessity for the use of diaphragms between the anode and cathode compartments. The former will give occasion for troublesome filtering operations, the latter, made of close texture canvas, are certain to require frequent renewal. No details of the costs of operating this process have appeared in print.

The Siemens & Halske Process.—This is an improvement of a process patented in the names of Maroh & Storer. The apparatus for working it is described in patent No. 13,434 of 1895. The process was experimentally worked out in Berlin, where the writer believes the production of zinc is still carried on in a small electrolytic and leaching plant erected for trial of the process. A solution of zinc sulphate is used as electrolyte. This is deprived of its zinc in vats divided into anode and cathode compartments by imperfect wooden partitions which serve in place of diaphragms. Lead is used as anode material. Circulation is maintained by means of an injector air jet as described in Chap. IX, on "Copper."** When the amount of free acid present in the electrolyte exceeds 10 grms. per liter, the solution is withdrawn and is used for leaching the crushed and roasted ore contained in specially designed leaching vats. This process is said to work well, and it has passed into the hands of a large company, "The Smelting Company of Australia," which, with a nominal capital of \$2,400,000 has bought mining property and erected works at Illawarra, New South Wales. No details of the costs of operating this process have been published by the inventors, but as Messrs. Siemens & Halske offered to extract the zinc from zinc sulphate solutions for the "Broken Hill Company" at a cost of \$22.08 per ton of zinc recovered, \$4.80 of which represented royalty on the process, it would appear that the actual working costs of the electrolytic part of the process are below \$17 per ton zinc. No particulars of the operations at Illawarra have yet come under the writer's notice; but, as in the case of the Ashcroft process, the final judgment concerning the commercial success of the process when operated on a large scale cannot be much longer delayed.

The Diiffenbach Process.—This process after many experimental trials has now entered upon its industrial stage of development at Duisburg in Germany, where 600 HP. is now utilized in producing zinc by electrolysis of a zinc chloride solution. The

* "Electro-Metallurgie," Borchers, p. 282.
† Jour. Soc. Chem. Ind., 1896, p. 414.

* Dingl. Polyt. Journal, Vol. CCXCVII, 1895, p. 191.
† Stahl u. Eisen, 1895, p. 906.

* Electricity, Nov. 17, 1897.

ore used is a zinciferous iron pyrites from the Siegen mines in Westphalia, and contains 8 per cent zinc before roasting and 15 per cent. after. The presence of this large amount of zinc prevents use of the ore for either sulphuric acid making or for iron smelting. The ore is crushed and is subjected to a roasting with common salt whereby the zinc sulphate is converted into a chloride. The ore is then leached, and the solution containing the soluble salts of zinc and soda is submitted to electrolysis. The residue in the leaching vats when the operations have been successfully conducted contains only .5 per cent. zinc, and is fitted for use by the iron works. The information at one's disposal concerning this process is not very definite, and it is not clear whether the methods of work and the vat arrangement, described in the British patent No. 25,804 of 1896, are being used at Duisburg. The production of zinc by this process is however apparently commercially successful, for after turning out 90 tons zinc per month over a considerable period, extensions of the plant are now being undertaken.

The Cowper-Coles Process.—A small syndicate, "The Cowper-Coles Zinc Extraction Syndicate," was formed in 1896 with a capital of £3,000 in order to give this process an experimental industrial trial at Hayle in Cornwall. No details of the process, the costs of operating it, or of the results obtained at Hayle have yet appeared in print, and one is therefore unable to express any opinion upon it.

In addition to the above four processes, experimental plants for the extraction of zinc from its ores are stated by Borchers to be working at Fuhrfurt a. d. Lahn, at Wiedenau, and at Nornberg, in Germany, and still another process is said to have been started in Duisburg at the works of Matthes & Weber. No details of these processes or of the results obtained are yet forthcoming.

Conclusion.—The theoretical amount of energy necessary to separate one ton of zinc from solutions of the sulphate can easily be calculated by aid of the electro-chemical equivalent of zinc.

736 ampere hours separate .897 kg. zinc.

The decomposition value of zinc sulphate as determined by Le Blanc is 2.35 volts. Basing the calculations upon these figures we find that to separate

one ton of zinc (1,000 kgs.) $\frac{1,000 \times 2.35}{.897}$ EHP. hours

are required. Taking the actual energy efficiency of any zinc depositing process at 33 per cent. * and the cost of the EHP. hour at \$.002, the cost of the electrical energy practically necessary to separate one ton zinc from a solution of the sulphate works out to

$$\frac{1,000 \times 2.35 \times 100 \times .002}{.897 \times 33} = \$15.88.$$

When the costs of operating the process and the depreciation and interest charges upon the capital outlay of the installation are added, it is apparent that Messrs. Siemens & Halske's estimate of \$22.08 per ton leaves little margin for profit.

In bringing this brief review of the electrolytic zinc extraction processes to a close, it must be noted that there is no great demand for pure zinc (the zinc obtained at Duisburg contains .02 to .05 per cent. impurities), and that consequently electrolytic zinc cannot depend upon a market similar to that which exists in the copper industry. The present difference in price between pure zinc and ordinary spelter will, therefore, not be maintained when the former is produced in large quantity; and electrolytic zinc producers cannot count upon obtaining a price much higher than that asked for spelter. With the latter at \$87.60 per ton, it is evident that the outlook for the electrolytic zinc extraction industry is not very promising, and it is only when working upon ores which cannot be successfully dealt with in any other way that these processes have the slightest chance of commercial success.

* This is the average energy efficiency obtained in the electrolytic copper refining industry.

CLONTARF ELECTRIC TRAMWAY.*

The Clontarf section of the Dublin United Tramways Co.'s lines has recently been electrically equipped over a length extending from the city boundary, at Annesley bridge, to Dollymount. The track throughout takes the line of the sea coast at the opposite side of Dublin Bay to that on which runs the electric line of the same company from Dublin to Dalkey. At the Dollymount end of the line are situated the famous golf links of the Royal Dublin Golf Club, which are largely patronized all the year round. The total length of the newly equipped line is slightly under three miles of double track, the gauge being 5 ft. 3 in. (which is the Irish standard gauge), the system of equipment being that of the overhead span-wire trolley.

The power house, which is situated at the Dollymount end of the line, is erected on a site previously used by the Tramways Company for stables and car houses, the buildings then existing being altered to suit the present requirements. It has been erected on the plans of the British Thomson-Houston Company, the building works being carried out by Mr. R. O'Connor, of Dublin, under the direction of the Dublin Tramways Company's engineer. The power house, including the car and repair shops, covers a space of 166 ft. by 140 ft. It is divided up into boiler house, engine house, repair shop, offices and car house, the latter being capable of accommodating 26 motor cars. In the boiler house are installed three boilers of the Babcock & Wilcox type built in one and a-half batteries. The main flue, which runs along the front of the boilers, is lined throughout with firebrick, and the gases can either pass directly through to the chimney or through a bypass via the economizer to the chimney. The chimney is built octagonally, the inside diameter being 7 ft. and the height to the top from the ground line 112 ft. There is a firebrick lining from the floor level of the main flue to a height of about 50 ft. Each boiler has a total heating surface of 2,197 sq. ft. and a grate area of 41 sq. ft. There are two drums to each boiler, which are cross connected. An economizer consisting of 160 tubes has also been erected in the boiler house. Water is supplied to the boilers by two direct acting horizontal Worthington steam pumps, each being capable of delivering to the boilers 22,000 gallons of water per hour against 150 lb. pressure, which is the working pressure of the boilers. A cast iron water tank with a capacity of 10,000 gallons has been erected in the boiler house, but in view of the possibility of the supply of town water not being sufficiently constant, a storage tank with a capacity of 38,000 gallons has been excavated on land immediately adjoining the engine house.

The feed-water piping is in duplicate throughout; it is of cast iron and so arranged that the supply can be taken from either of the water tanks direct to the boilers, or through the economizer. The steam main, also in duplicate, is of lap welded steel pipes with cast steel flanges; branches are taken to the boilers and engines. Either steam range may be worked independently of the other.

The engines, three in number, were built by Messrs. McIntosh & Seymour, and are of the horizontal tandem compound type directly coupled to six-pole 150 kilowatt 500 volt British Thomson-Houston Company's generators running at 200 revolutions per minute. The length of stroke of the engine is 17 in., the diameter of the high-pressure cylinder being 11½ in. and that of the low-pressure 23 in. Both cylinders are provided with valves of the piston type, these valves being provided with an adjustable seat for preventing leakage. The seat consists of two rings made in one piece and connected by several bridges across the port openings which the space between them forms. All the bearings on the engines are lined with Babbitt metal,

* From *The Electrician*, London.

hammered in and bored out. On each engine is fitted a steam separator, this being placed immediately over the main stop valve.

The generator armatures, which are drum wound, have special ventilating ducts and highly laminated cores. The laminæ are dovetailed into the spider supported from the shaft, and are insulated from each other by means of jappanning. The armature windings consist of interchangeable copper bars set into slots in the periphery of the core, insulated all over with layers of paper and mica. The end connections of the armature windings are in one piece with the body of the winding and lie upon the circumference of the same cylinder. The inner surfaces of the end connections are protected by a metal flange from the spider extending laterally to support these end connections. The commutator is of hard-drawn copper insulated with mica. The field frame and magnet cores are of steel, the latter being removable without disturbing the field frame or armature. The coils are wound on separate bobbins so that they can be readily slipped on and off. The brushholders are supported radially, and are constructed with end play to admit of uniform wear of the commutator.

These generators are designed so as to deliver an overload of 25 per cent. above their rating for two hours without overheating. They are also capable of sustaining sudden brief fluctuations up to 50 per cent. above their rating and down to zero without injurious sparking at the commutator, and without requiring the brushes to be shifted.

The switchboard is of the standard form and construction, there being one complete panel for each generator, containing the necessary switches and instruments, including an automatic circuit breaker of the magnetic blow-out type, quick break switches, etc. Each feeder panel is designed for two circuits, and contains circuit breakers and an ammeter for each circuit. There is also a total output panel, with Thomson recording wattmeter, and a leakage panel according to the Board of Trade requirements.

The lights for the power house are supplied from one of the British Thomson-Houston Company's marine type of generating set, consisting of a high-speed vertical engine, coupled direct to a four-pole 10 kilowatt generator, running at 656 revolutions per minute. The lighting is both by arc and incandescent lamps.

An overhead traveling crane, built by Messrs. Jessop and Appleby, of six tons capacity, runs the whole length of the engine house. The lifting and traversing gears are arranged so as to be worked by hand from the floor.

There are two main feeder cables for the tramway supply, each feeder being looped at intervals into a switch pillar. Each of these switch pillars contains six quick-break switches, so arranged that any section of the line or feeder may be cut out without interfering with any of the other sections. The switch pillar also contains a magnetic blow-out lightning arrester, connected to the trolley line.

The overhead trolley line construction, which is on the span-wire system throughout, is erected in the following manner: The poles, which are 29 ft. 6 in. in length, are built up in three sections of 5 in., 6 in. and 7 in. tubular steel, made with overlapping joints, shrunk together while hot. This type of pole, while containing a minimum amount of metal, has been specially designed to sustain the strains incidental to the operation of an overhead trolley system. The poles are spaced at an average distance of 120 ft. apart. There are two trolley wires throughout composed of No. O. B. and S. gauge hard-drawn copper wire, divided up into half-mile sections, as required by the Board of Trade. The track, which has been relaid by the Dublin United Tramways Company with a 7-in. girder rail, has been efficiently bonded with Chicago 4/0 by 30 in. bonds. It is also cross-bonded at short intervals. There are no grades or curves of any note throughout the entire length of line, and there is only one point where there is any variation in the height of the overhead

line over the track, this being where the track passes under a railway bridge. Here the line is dropped from an elevation of 21 ft. to 17 ft.

Both the original and the new tracks in the car shed and the repair shops have all been wired, so that the cars may be moved electrically to any desired place.

Fifteen motor cars have been equipped for this tramway service, 12 of the bodies having been built by Messrs. Milnes & Co., Birkenhead, and the remaining three by the Dublin United Tramways Company. The cars are double-decked and are exceedingly roomy. They are built to accommodate 54 passengers each, of whom 25 are carried inside. These cars are similar in most respects to those in operation on the company's Dublin and Dalkey section. The cars are electrically lighted. The car bodies are mounted on "Peckham" cantilever trucks, with 33 in. wheels. The springs supporting the car body comprise four elliptical and twelve coil springs, so combined and graduated that the weight of the car comes first upon the elliptic springs and as the load increases the spiral springs come into play. The brake beams are of wrought steel bars, the brake leverage being ten to one advantage. The brake-shoes are so constructed as to be interchangeable and easily removed without loosening a bolt. Each truck is also fitted at either end with an adjustable life and wheel guard which can be adjusted to any desired height from the track.

The electrical equipment of each car comprises a trolley-pole and base of the swiveling arm type, with the wheel mounted on a pivot fitted so as to prevent it from catching in the span wire. There is also a special arrangement for bringing the wheel back into line should it jump the wire. This wheel is so constructed that should it wear through the rims will not drop off. The trolley pole is of light steel insulated by means of braiding, the pole being insulated from the socket, which is on a pivoted base supplied with ball bearings. The electrical connections between the fixed and rotating parts is of such construction that the cables cannot be twisted off. There are two main motor switches, one at either end of the car, one of these being so designed as to act as an automatic magnetic blow-out circuit breaker. The controllers are of the British Thomson-Houston "K2" series parallel type, and embody the magnetic blow-out principle. They are fitted with an interlocking arrangement by which the power handle cannot be moved except when the reversing handle is set to run either forward or backward. The reversing handle is so designed that it can only be moved at the "off" position. These controllers also contain an emergency stop switch whereby the car can be very quickly stopped, owing to the breaking action effected by so connecting the motors that they become, for the time being, generators. This emergency stop is entirely independent of any extraneous source of electric supply.

The motors are of the well-known "GE 800" type, there being, as usual, two motors on each truck.

It is proposed to extend the line from Dollymount to the sea-side resort of Howth, a distance of about six miles, and ample room exists in the power-house for the plant rendered necessary when this extension is carried out.

A Third Rail Line in Germany.

The Wann See Railway, for which there was lately issued a prize competition for proposals to enable the increased traffic to be coped with, is to be worked by electricity if the trials now to be made are successful. The line, which is about $7\frac{1}{2}$ miles long, is between Berlin and Zehlendorf. The trial train is expected to make 15 double journeys per day with a load of 210 tons each. The current is to be conducted to the train by a special conductor rail 1 ft. above the edge of the running rails. The conductor rails will be carried upon insulators placed four or five yards apart. The latter will be fixed upon wooden saddles, which will be firmly attached to the ends of

the sleepers. The return current will pass through the running rails. The compressed-air brake now in use is to be retained; the air will be pumped by electromotors, but trials will also be made with an electrical brake. The line current will be used to light the carriages. Accumulators on the cars will be employed to prevent extreme fluctuations in the light.—*Electrical Engineer, London.*

THE RAND CENTRAL ELECTRIC POWER PLANT.

Stretching east and west of Johannesburg for a distance of about 25 miles is the gold-mining district of the Rand. There is an enormous amount of power demanded for the various operations connected with the industry on the reef; in fact, it is estimated that a capacity in steam engines amounting to a total of 20,000 HP. is installed amongst the various mines in the district. The inefficiency with which this power is developed, generated as it is by units of small capacity, coupled with the high price of coal at the mines, in consequence of the oppressive railway rates, render the cost of power to the mines under this regime prohibitive. This combination of conditions was the cause, some time ago, of a proposal to establish a central power generating station in or close to the Rand. The first idea was to develop the power from the falls of the Vaal River, but lack of water in the dry season was the cause of this plan being abandoned. It was finally decided to erect a power station near the shaft of the Brakpan coal mine of the Transvaal Coal Trust Company. A franchise was obtained from the Transvaal Republic for the lighting of Johannesburg and for transmitting power by an overhead transmission line to the Rand. A contract was also entered into with the coal company binding it to furnish all the coal required by the Central Electric Works for a period of 55 years. Work was started on the station in September, 1895, and, owing to an agreement with the railway company, the material was transmitted to the site without transshipment.

The station is situated about a mile and a-half from the colliery, but a down grade exists the whole length of the line from the latter to the station, so that the only need for a locomotive under the present arrangements is to haul back the empties to the colliery. The coal or "slack" is tipped from side-discharge trucks on to a corrugated iron tunnel, whence it falls into a spiral conveyor, which in turn discharges on to a belt elevator at the western end of the boiler-house. From the elevator the coal is distributed at intervals into the bunkers by two spiral conveyers which run the whole length of the boiler-room.

This room is 250 ft. long by 48 ft. wide. It has two wings, each capable of housing five boilers. The two iron chimneys are 16 ft. in diameter at the base, and 10 ft. at top. Automatic stokers of the Leach pattern are used. The fuel conveyers and stokers are worked by electric motors. Eight boilers are at present installed, and two more are to be erected. They are of the Steinmuller multitubular type each of 600 IHP., with 3,300 sq. ft. of heating surface, and supply about 2.2 lbs. steam per hour per square foot of surface. The steam pressure is about 200 lbs. The limited supply of water available has rendered necessary careful arrangements for supplying and purifying the feed water. Surface condensers are used, and no fresh water is allowed to enter the boilers without being filtered. A reservoir of a capacity of 22,000,000 gallons is adjacent. The engine and dynamo room measures 230 ft. by 76 ft. wide. The framework is of iron, and the roof as well as the walls are of wood covered with corrugated iron. A 25-ton overhead traveling crane spans the width of the room. There are four units at present installed, and there is room for a fifth. The engines are triple-expansion, and of the vertical marine type manufactured by the Sächsische Maschinen Fabrik of Chem-

nitz. The high-pressure cylinders have a diameter of 22½ in., the intermediate cylinders are 36 in., and the low pressure 57 in. in diameter, the stroke being 35½ in. These engines have a normal brake horsepower of 1,000, and are capable of developing a maximum of 1,500 IHP. Coupled direct to each engine is a 1,145-kilowatt three-phase generator and its exciter. The armatures are stationary and in the form of a ring, having an internal diameter of 15 ft. The field magnet revolves within the armature, being keyed to the shaft driven from the engine. The speed is 100 revolutions per minute. Each of the generators weighs 80 tons and with their engines are mounted on a continuous bed of concrete resting on hard rock about 16 ft. below the level of the floor. Three only of the units are in constant use, the fourth being held in reserve. The generators supply current at 700 volts pressure.

In a gallery at the eastern end of the building are located the step-up transformers which raise the pressure from 700 to 10,000 volts for the transmission of the current on the line. The latter consists of six copper conductors carried on steel poles 20 ft. high, made by the Mannesmann Tube Company of South Wales; the cables are fitted with a wire net-like arrangement underlying them for the purpose of catching and keeping them from the ground in case of breakage. The lines are set spirally throughout their course, and the cables are topped by a line of ordinary barbed wire to act as a lightning conductor. Further to guard against the effects of lightning the Siemens & Halske lightning arrester is employed. The latter consists of two heavy copper wires bent into a certain shape. These wires are held in cast-iron clips attached to porcelain insulators, while the lower ends of the wires are adjustable, so that their distance apart at the place where they are closest together may be altered. One wire is put to earth and the other connected to the circuit to be protected. When the circuit is struck by lightning the arc which follows travels upwards between the two horns (as high-pressure arcs are known to do) and fails when its length becomes too great to sustain. About 2,000 volts is the lowest limit of pressure for the line which this arrester will protect. No rain guard is required if the distance apart of the horns is not too small.

Close to each mine taking current a transformer house is erected, containing besides transformers the measuring instruments and safety devices. The transformers in these little sub-stations step the pressure down from 10,000 to 120 volts for lighting or to 240 or 500 volts for motors. There are two methods of charging for power supplied. By one rating £45 per annum is charged per horse-power measured at the motor shaft, the power company putting up and maintaining all the electric plant; on the other system 1.85d. is charged per kilowatt hour as measured by meter. This latter payment is, however, subject to a sliding scale, by which the rate is varied according to the time of running and the amount of current used.

The longest stretch of line is to Krugersdorp, some 28 miles from the station. It is intended to light various suburbs of Johannesburg by this power, and already some railway stations are being lighted. The demand for current is good and eight or nine mining companies are already customers and using the power for various purposes, including air compressing, pumping, ore reduction, hauling and the working of slimes plant. There are now about 38 motors on the circuit, varying in capacity from 3 HP. to 250 HP. It should be added that the whole of the work has been carried out by Messrs. Siemens & Halske.

Species of Cathode Rays.

According to E. Wiedemann and G. C. Schmidt, cathode rays emerge from a point of the cathode in two essentially different manners. The first kind consists of a solid cone, which produces a patch on the glass wall. The second is a hollow cone, which produces a green ring on the tube wall. Both forms

† From *The Electrician*, London.

occur simultaneously. To study the second kind in their utmost simplicity the authors first of all experimented with electrodeless tubes between the terminals of a Lecher wire system with one bridge. The vessels used were glass spheres, which were placed against a ball electrode. A small bright point appeared against the electrode, and a hollow cone of rays proceeded from that point. Measurements of the angle of this cone showed that it slightly decreases as the sphere decreases in size, but that it rapidly increases with the curvature of the electrode and with the exhaustion of the vessel. If the electrode is not a sphere but a circular ring of thick wire with its plane at right angles to the surface, the figure produced on the wall is of an oval shape, with its major axis normal to the plane of the ring. Ring figures may also be obtained in electrodeless cylinders terminating in plane glass plates. If a ball electrode or a ring is placed against the center of one of the plates, rings and ovals are obtained just as in the case of the sphere. In one experiment of considerable theoretical interest, the two plates were covered with tinfoil on the outside. A chalked screen, *b*, was introduced into the cylinder, and a smaller paper screen, *c*, was placed parallel to the former a short distance below it. A bright red ring then appeared on the chalk, separated from the cylindrical walls by a black ring. Inside the red ring there was some light, especially towards the center. As exhaustion proceeded the dark ring steadily crowded the bright ring towards the center. The screen *c* threw a shadow on *b* corresponding to cathode rays perpendicular to the plane ends. The authors conclude that the cathode rays proceed from the separating surface between a solid and a gas in the direction in which the currents producing the oscillations traverse that surface.—*London Electrician*.

A correspondent writes: "Whenever I think I have found anything new about Roentgen light I have only to turn to the work 'Roentgen Rays and Phenomena of the Anode and Cathode' to find that some one else discovered it first."

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

Motion of the Ether.

It will be remembered that Michelson some time ago, says the *Electrician*, London, endeavored to detect a difference in the motion of the ether at different heights above the earth's surface, by sending a beam round a rectangular path 200 ft. long in a horizontal direction and 50 ft. long vertically. No trace of relative motion was detected, and the conclusion was that either the ether is quite unaffected by the earth's motion, or that it is dragged along with it to a distance of many thousand miles above the surface. H. A. Lorentz (Verslag Akad., Amsterdam, November 10, 1897,) criticises these conclusions in detail. It is not inconceivable that the glass covers of Michelson's iron tubes do not allow the ether to penetrate, although they probably do so. On the other hand, an extension of the earth's influence to a distance comparable with the earth's diameter is not unthinkable. If the dragging is analogous to that exerted by a gas upon a solid sphere traversing it, the velocity imparted to the ether by the earth could well be $\frac{1}{2}$ of that at the surface at a height equal to the radius, and $\frac{1}{4}$ at a height equal to the diameter of the earth. But in that case some displacement of the fringes should have been observed.

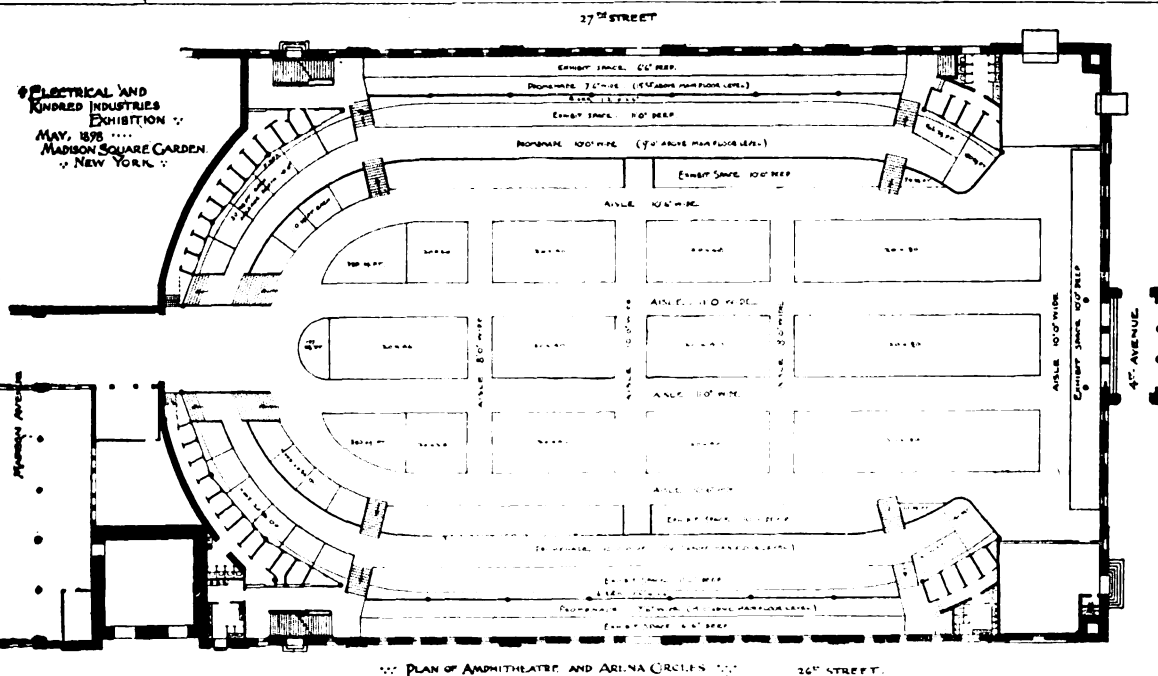
For at midday or midnight, when the earth's surface moves in the direction of the earth's path or against it, and the dragging is likely to reach a maximum, a displacement of $\frac{1}{4}$ th of the distance between two of Michelson's fringes should have been produced. This would have been well within the limits of observation.

THE ELECTRICAL SHOW.

Interest in the next Electrical Show, to be held in Madison Square Garden in May, has already gone beyond the electrical into the kindred trades and is surprisingly strong in all branches. Everybody remembers the splendid success of the show in 1896.

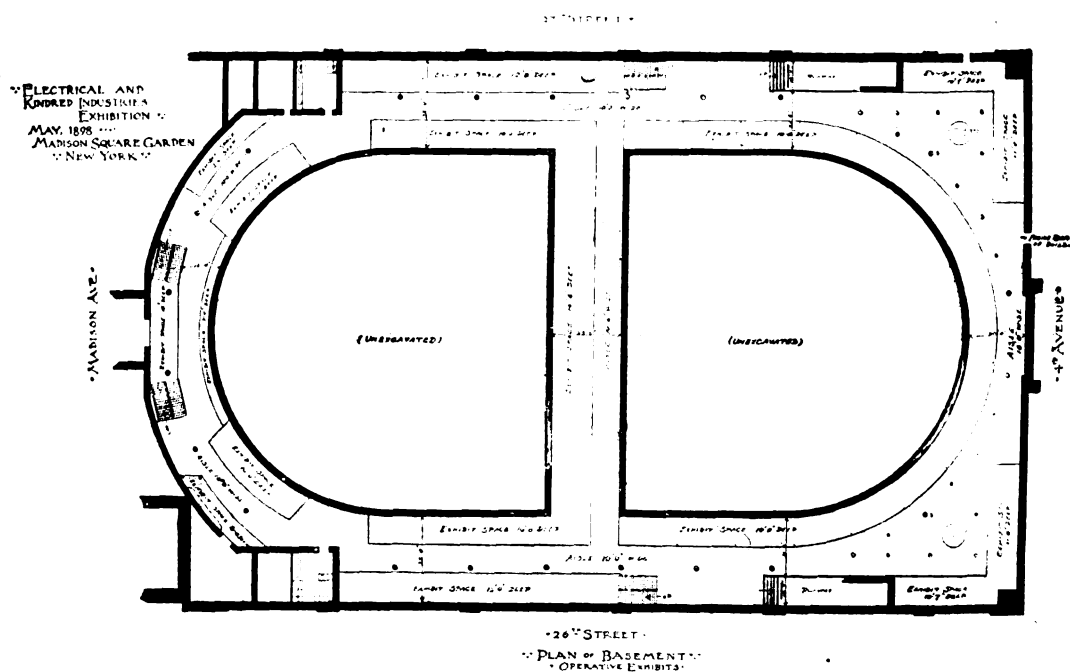
the several months before, it will be readily seen that late comers may be losers.

When the management took a lease of Madison Square Garden it was thought to be a rather bold step. As the plans are now developing, it is evident that so big a building is absolutely necessary. The exhibitors cannot but profit by the larger, finer, better known and more centrally located building. The advantage of location and building, the increase both in variety and number of exhibits will certainly draw a much larger crowd. There were over 300,000 admissions in 1896, and it seems reasonable to expect that the number will run up pretty close to the million mark in 1898. Other comparisons with the



Then it was held in a building comparatively unknown for such exhibiting purposes, yet it attracted not only the trade but great throngs of people from the territory within 100 miles of New York. The exhibitors themselves were paid many times over in business for the cost of their respective exhibits, and the best evidence of this fact is in the early demand

last show run in just as large proportions. For instance, there was only one battery of boilers in operation in the 1896 Exhibition. From the arrangements already made, there will be at least three in the Madison Square Garden show. The engine and dynamo exhibits will exceed those of the last show by about three to one. All these things suggest to



from former exhibitors for increased allotments of space.

Contracts are already in for more than one-half of the total space sold in 1896. When it is remembered that the Exhibition is five months away and that at the last one, as usual in such exhibitions, more space was sold just before the opening of the show than in

intending exhibitors the importance of speed in securing space. While the Garden is very much bigger than the last Exhibition building, the demand for space is even greater in proportion than the increase of space, and of course the walls of the Garden put up an unyielding limit to the supply. The accompanying diagrams show a proposed arrangement

of exhibits in the amphitheater of the Garden where apparatus, supplies, etc., will be located, and the basement in which will be the generating exhibit and steam specialties.

From interest already taken in it by boiler, engine, pump and steam specialties companies, it is evident that the illustration of the various apparatus and supplies will be complete, varied and interesting, and public interest in these things will no doubt lead the newspapers to give the show a great deal of notice.

It seems proper to say a word about this generating exhibit. In the old building with a smaller and less interesting plant and only one entrance by an obscure stairway from the main hall, it proved to be a feature of public as well as trade interest. Enough interested people found their way to it to make it profitable to the exhibitors. In Madison Square Garden, not only will the exhibit be larger, more varied, more interesting, but it will be more accessible. There will be at least four entrances from the three sides of the building, and the skill and care in placing the exhibits, pointing out the features and properly advertising them, which made the last operative exhibit successful, ought to make this one at least four or five times as successful.

The Manufacture and Storage of Acetylene Gas.

We are very glad to see that the Board of Fire Commissioners of Jersey City have at last adopted strict regulations regarding the manufacture and storage of acetylene gas. The regulations provide as follows:

"That the manufacture of carbide of calcium or the liquefaction of calcium of carbide be prohibited except under certain prescribed limitations to be designated by the board. That it declines to permit the use of any acetylene gas regenerator in this city except those devices first submitted to the board for careful test, examination, and approval of the board. That after the careful examination made into the methods of operation of the Bournonville gas regenerator, and finding the same to be operated on safe scientific principles, and in view of the small quantity of carbide treated by said device and the careful storage and distribution of the same, that the embargo laid by the board against the use of this machine be withdrawn and its operation sanctioned, provided that the methods now employed be not altered or made more dangerous.

"It is further provided that the use or storage of calcium of carbide be confined to quantities of five pounds each, which must be stored in heavy block tin vessels, and until ready for use hermetically sealed, and that no dwelling, factory, or other building be permitted to keep on storage a total quantity in excess of twenty-five pounds in cans or vessels of five pounds each.

"All parties desirous of storing in this city a quantity of calcium carbide or liquefied acetylene gas in excess of the limitations above defined to be allowed to do so only upon formal request to the board and special permission obtained therefrom."

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

ELECTRICAL EXPORTS.

The United States Treasury Department has completed the compilation of the statistics covering the exports and imports during the last fiscal year. Hon. Worthington C. Ford, the head of the division which is entrusted with the preparation of these statistics, states that the exports of our manufactures have never been so large as they now are, and the rapid increase during the last few years is indicative of a growing appreciation of American products abroad.

The statistics which relate to electrical apparatus constitute a highly interesting exhibit to the manufacturers and dealers in these lines. While the imports of electrical apparatus are nil, the exports, as

will be seen by the following list, amount to a good round sum:

From	Values.
Baltimore, Md.....	\$1,713
Bangor, Me.....	4,568
Boston and Charlestown, Mass.....	57,411
New York, N. Y.....	2,345,778
Passamaquoddy, Me.....	87
Philadelphia, Pa.....	5,944
St. Johns, Fla.....	50
Corpus Christi, Tex.....	79,173
Mobile, Ala.....	14
New Orleans, La.....	2,384
Paso del Norte, Tex.....	37,604
Pensacola, Fla.....	30
Saluria, Tex.....	13,400
Arizona.....	7,635
Puget Sound, Wash.....	71,120
San Diego, Cal.....	290
San Francisco, Cal.....	141,286
Buffalo Creek, N. Y.....	22,082
Cape Vincent, N. Y.....	1,347
Champlain, N. Y.....	74,787
Detroit, Mich.....	17,238
Genesee, N. Y.....	32
Huron, Mich.....	28,873
Montana and Idaho.....	24
North and South Dakota.....	15,277
Oswegatchie, N. Y.....	39,040
Oswego, N. Y.....	14
Superior, Mich.....	1,708
Vermont.....	79,540
Total.....	\$3,054,453

The countries to which these exports were sent are as follows:

Austria-Hungary.....	\$2,203
Belgium.....	168,864
Denmark.....	4,007
France.....	298,133
Germany.....	240,577
Italy.....	86,281
Netherlands.....	6,224
Portugal.....	3,205
Russia, Baltic and White Seas.....	33,445
Russia, Black Sea.....	4,223
Spain.....	2,188
Sweden and Norway.....	1,984
Switzerland.....	1,043
United Kingdom.....	437,046
Bermuda.....	2,236
British Honduras.....	330
Dominion of Canada:	
Nova Scotia, New Brunswick, etc.....	22,242
Quebec, Ontario, etc.....	261,104
British Columbia.....	21,317
Newfoundland and Labrador.....	5,926
Central American States:	
Costa Rica.....	12,550
Guatemala.....	43,703
Honduras.....	3,958
Nicaragua.....	7,529
Salvador.....	29,383
Mexico.....	284,714
West Indies:	
British.....	26,586
Danish.....	303
Dutch.....	6,359
French.....	304
Hayti.....	4,879
Santo Domingo.....	8,536
Spanish—Cuba.....	30,375
—Puerto Rico.....	22,801
Argentina.....	157,564
Brazil.....	110,468
Chile.....	32,359
Colombia.....	66,084
Ecuador.....	7,550
Guiana, British.....	6,435
Dutch.....	12
Peru.....	14,650
Uruguay.....	2,721
Venezuela.....	80,226
China.....	5,833
East Indies, British.....	20,924
Dutch.....	212
Hong Kong.....	2,510
Japan.....	148,271
Turkey in Asia.....	263
All other Asia.....	1,559
Auckland, Fiji, etc.....	120
British Australasia.....	58,348
French Oceania.....	14
Hawaiian Islands.....	53,512
Philippine Islands.....	3,054
British Africa.....	180,389
Canary Islands.....	137
Portuguese Africa.....	456
Turkey in Africa—Egypt.....	11,851
All other Africa.....	3,824
Total.....	\$3,054,453

BOOK REVIEWS.

ARITHMETIC OF THE STEAM ENGINE. By E. SHERMAN GOULD. M. Am. Soc. C. E. 8vo, p. 104. New York: D. Van Nostrand Company. Price, \$1.00.

This attractive little volume, although it contains nothing strikingly new regarding steam, will be found exceedingly useful to anyone interested in steam and its applications to the steam-engine. The work contains a large number of problems that arise in everyday practice, and in each case gives a simple method of arriving at an accurate solution. Several carefully compiled tables are to be found at the end of the volume, on the properties of saturated steam and on hyperbolic logarithms. Altogether this little volume would seem to fill a long felt want for a simple and practical method of determining questions that are constantly arising in the application of steam.

MECHANICAL DRAFT. By B. F. STURTEVANT. Pp. 377. Boston, Mass.: Sturtevant Engineering Co.

This valuable work discusses at great length the subject of mechanical draft. No efforts have apparently been spared to make the work complete, accurate and thoroughly up to date. There seems scarcely any doubt but what the subject of mechanical draft and its advantages has been heretofore more or less overlooked or at most discussed in a cursory manner. This volume, therefore, which is fully illustrated and which shows by actual comparisons taken from practice the great advantages to be derived by the use of mechanical draft, will be welcomed by engineers generally. It not only treats of mechanical draft, but of the efficiency of fuels, efficiency of boilers, steam, combustion and various other topics in this line. Besides being handsomely illustrated, valuable tables, diagrams and charts are scattered throughout the volume, showing the results of tests of steam plants in various parts of the country.

Everyone engaged in the design of works of this nature would do well to procure this work, if only to read Chapter XI, which very forcibly brings out the advantages of mechanical draft.

CANADIAN NOTES.

A comparative statement of earnings of the Montreal Electric Street Railway shows the earnings of the month of December last were \$113,128.91, as against \$103,116.02 for the same month last year. The total earnings for the last three months of 1897 were \$340,351.60, giving an increase over the like period in the year previous of \$27,306.63.

The Niagara Power Company, if forced to develop power on the Canadian side of the line, must look to Toronto, it is said, for an immediate market, to which city the question of power transmission is already being considered by the company. The rival concern, which proposes to utilize the Welland River power, also looks to the city of Toronto for its most important market. The Electric Light Company of Toronto, which has a large amount invested in plant for the production of electricity from steam, will not eagerly welcome the advent of water-produced power and is making a strong fight against its introduction.

The Dominion Government purposes putting in an electrical installation in all the departmental buildings at Ottawa. At present the Parliament block is electrically lighted. The intention is to erect a power house to supply all the Government buildings with electric lights, and also with energy to work electric pumps for fire purposes in every building.

A motion has been introduced into the Ontario Legislature to the effect that, in the opinion of the House, the water-power of Niagara Falls and rapids being one of the great natural resources of the province, should be developed and utilized for the benefit of the Canadian people, and that to this end the Government should favor all bona fide enterprises proposing the development of this power.

LEGAL NOTES.

The judgment secured by the Atlantic Trust Company for \$95,426 on its counterclaim in a suit brought against it by the Consolidated Electric Storage Company has been reversed by the Appellate Division, New York. A new trial is granted and the opinion is expressed that plaintiff was entitled to recover the balance remaining undisposed of of the sum of \$215,000 deposited with the defendant in pursuance of an agreement between the plaintiff and defendant and other parties made in June, 1890. Under this agreement the United Electric Traction Company gave its note for \$215,000, with collateral security, for the purpose of securing that amount to the Brush Electric Company. The defendant agreed to pay to plaintiff any part of this sum not needed to secure the Brush Company. The Traction Company failed to pay this sum, and the collateral security, consisting mainly of stock of the company, turned out to be valueless. Then it was that defendant claimed a reformation of the contract and a judgment in its favor. The opinion of the court was by Justice Ingraham, Justice O'Brien dissenting.

Judge Showalter has appointed General John McNulta receiver for the Calumet Electric Railway Company, Chicago, to succeed John C. McKeon. The appointment was made in view of the fact that General McNulta was recently appointed receiver for the National Bank of Illinois, and that the Calumet Electric Railway is an asset of that bank. The bank financed the Calumet company for \$2,700,000.

Motions for a new trial have been filed in the case of Louis M. Packer of Lynn vs. the Thomson-Houston Electric Company, in which the plaintiff sued for \$100,000 for the loss of both hands in an under-cut machine at the defendant's works and was recently awarded \$20,000 by a jury in the Superior Court at Salem, Mass. Both sides ask for a new trial. The plaintiff wants the verdict set aside upon the ground that the damages found by the jury are inadequate.

R. E. Rust, receiver of the National Electric Manufacturing Company of Eau Claire, Wis., has been discharged by the court.

Leslie W. Ryan, a well known lawyer of Boston, and one of the counsel for the Reorganization Committee of the Thomson-Houston Electric Company, was arraigned before Judge Cowing in the Court of General Sessions, New York, on the 3d inst. upon a charge of perjury. An indictment was found more than a month ago on the complaint of Henry Winthrop Gray, the receiver for the Thomson-Houston Company. It was alleged by Mr. Gray that in winding up the affairs of the company Mr. Ryan made an affidavit that he had turned over to the receiver \$70,000 to be used for the benefit of the creditors. Mr. Gray says he never received this money, and that he has been placed in a false light, inasmuch as he has made no accounting for this sum. Mr. Ryan when taken into custody declared his arrest an outrage, and asserted through his counsel that he had paid the \$70,000 to the creditors of the company through another channel than Mr. Gray, who was incensed against him on that account and preferred the charge. The court held Ryan in \$2,500 bail.

The jury in the suit of the Fort Wayne Electric Corporation against the Franklin Electric Light Company, at Cape May, N. J., returned a verdict for the Fort Wayne company, giving it \$12,423.05. The amount sued for was \$16,700 and interest, which was the cost of the plant when built about a year ago. The case will probably be appealed by the Fort Wayne company.

American Association of Inventors and Manufacturers.

The eighth annual meeting of the American Association of Inventors and Manufacturers will be held in Washington, D. C., on the 18th inst. This association has for its object the maintenance, fostering and protection of the patent system of the United States, with the desire to increase the efficiency of operation and to promote the stability of patent property.

The association has also in view steps to procure

from Congress legislation authorizing the Patent Office, a department of the Government which pays all of its expenses out of its income, to spend so much of that income as may be necessary for the scientific, thorough and efficient examination of applications for patents, to the end that patents may be granted only for inventions which are undoubtedly new.

New York Electrical Society.

The 184th meeting of the New York Electrical Society will be held at the College of the City of New York, Twenty-third street and Lexington avenue, on the evening of January 12 at 8 o'clock.

Mr. S. Dana Greene will read a paper on "The Relations Between the Customer, the Consulting Engineer and the Electric Manufacturer."

It will be the aim of Mr. Greene in this paper to assist in bringing about that better understanding between these departments of the industry on which much of its welfare and prosperity depends.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

GENERAL NEWS.

What is Going On in the Electrical World.

Albany, N. Y.—The construction committee of the water board, or at least two of the three members—Messrs. Hazen and Bailey—recommend the use of electricity as the motive power for the pumps at the filtration plant, bids for which will be received between January 15 and February 15. In their reports Mr. Hazen estimates cost of steam plant complete at \$27,900, and Mr. Bailey at \$21,800. Mr. Hazen estimates cost of construction of electric plant at from \$30,000 to \$35,000, and Mr. Bailey at \$37,830. The use of electricity was recommended in both reports.—The "Times-Union" says: "The work of constructing the roadbed for the proposed electric railway from Greenbush or Rensselaer to Nassau will not be resumed until spring. The reason is the contractors, J. M. Sullivan & Co., of New York, are loth to put any more money into construction until the finances of the company assume a brighter outlook. The contractors say that they have expended eighty thousand dollars thus far and want some money from the railroad company. The latter hold an agreement with a banking firm in New York to take the entire issue of bonds, \$325,000, as soon as the road is completed."

Atchison, Kan.—The Atchison Gas, Electric Light & Power Company for a consideration of \$100,000 has conveyed all its property to the Atchison Railway, Light & Power Company, and B. P. Waggener conveys Forest Park to the same company for \$25,000. The officers of the company are: J. P. Pomeroy, president; W. P. Waggener, vice-president; C. S. Hetherington, treasurer; J. M. Chisham, secretary, and J. A. Bendure, superintendent.

Aurora, Ill.—A company is being formed among the business men of Aurora for the manufacture of an electric railway signal. E. S. Hobbs is president of the company and E. D. Warner of Jackson, Mich., who holds the patent, will act as manager. A factory is to be started here and the stability of the men whose names appear in the list of stockholders assures the success of the concern.

Berlin, Ger.—The German Transoceanic Electric Company, with headquarters in Berlin, has been formed, with a capital of 10,000,000 marks, for the purpose of erecting electrical stations in America. A central station will first be established at Buenos Ayres for lighting and general supplies.

Brookfield, Mass.—Capitalists interested in the Southbridge & Sturbridge Street Railway Company and the Warren, Brookfield & Spencer Street Railway Company have matured plans to connect these two lines by building an electric railway from Central Square in Brookfield, to a point near the Worcester south agricultural grounds in Sturbridge. It is expected that the new road will be built this year. It will be about seven and a half miles long.

Chicago.—Mayor Harrison at the request of Chief Swenick of the Fire Department will ask the city council for authority to separate the electrical bureau from the fire department at the city hall and make each independent of the other with its own head. The bureau as it now is sprang up as a result of the use of the fire alarm system and always has been connected with the fire department. Since its establishment, however, it has been extended until the superintendent of city telegraph now has charge of all the wires in the city, the enforcement of the laws pertaining to them and the superintendency of the various municipal lighting stations.

Cincinnati, O.—The Standard Electric Works has changed its title and has taken out incorporation papers as the Standard Electric Company and with a capital stock of \$50,000. Captain E. Y. Cherry will continue as president of the concern and the other officers remain the same.

Cleveland, O.—The Cleveland, Kent & Ravenna Electric Railway is to be the name of a new line which a number of capitalists have in contemplation. As the title indicates, the road is intended to connect Ravenna with Cleveland. Among those said to be interested are Richard L. Palmer and Col. Vincent A. Taylor of the Chagrin Falls Electric Railway.

Colorado Springs, Col.—A system of electric signal and messenger service similar to that of the American District Telegraph is to be established here by M. A. Liddy, J. E. Voorhees and others. A twenty-year franchise has been granted to Mr. Liddy by the city council.

Detroit, Mich.—The "News" states that the Jenney Electrical Company, which Mayor Maybury expected to locate in Detroit, has gone to Madison, Wis. The mayor says it forsook Detroit because the owners received no encouragement here.

Dubois, Pa.—The Dubois Street Railway and Electric Light Company's plant has been purchased by a syndicate headed by John E. Dubois.

Great Barrington, Mass.—A company to be known as the Stanley Instrument Company was launched here on the 28th ult., the object being to establish works in this neighborhood for the manufacture of electrical instruments devised by Messrs. Stanley and Darlington, two of the directors and both of wide reputation as electricians. The officers of the company are: President, Frank H. Wright; vice-president, William Stanley; manager, Frederick Darlington; treasurer, John H. C. Church, all of Great Barrington; clerk, John S. Fuller. The directors are: Frank H. Wright, lawyer, of Great Barrington; Charles E. Yerkes of Chicago, president of the Siemens & Halske Company; John L. Dodge, president of the Mahawee National Bank, Great Barrington; Parley A. Russell, Great Barrington; John B. Beebe, physician, Great Barrington; Frederick Darlington, Great Barrington; W. H. Browne, manager of the Royal Electric Company, Montreal, Can.; Charles R. Huntley, general manager of the Buffalo General Electric Company, and William Stanley of Pittsfield. The capital stock of the company is \$75,000. In its announcement of the formation of the company the Great Barrington "Courier" says: "It is a well-known fact that Pittsfield has profited to an almost incalculable extent by the benefits flowing from the location of the Stanley Electric Manufacturing Company in that place, and it is believed that with the growth and development of the business of the company just organized, Great Barrington will receive a very substantial benefit in a manner which will be felt by all the people of the town."

Hagerstown, Md.—It is reported that a company of local capitalists is anxious to build an electric light plant in this city if the street commissioners decide that the electric light company now operating here has forfeited its franchise by violating its contract.

Hoboken, N. J.—The electric locomotive which is to draw freight trains on the Hoboken Shore Road made its initial trip over the road on the 4th inst. and worked satisfactorily, moving with apparent ease eight loaded freight cars, weighing about 260 tons. The locomotive is similar to those in use in the Baltimore tunnel. The Shore Road is only two miles long, and was built to facilitate the transportation of freight to and from the steamship docks.

Holland, Mich.—It is understood here that the financial difficulties which stopped work on the Holland & Lake Michigan Electric Railway are now being settled and work will be resumed on the road as soon as the weather will permit. The extension of the line to Saugatuck is now assured.

Hudson, Wis.—Christian Burkhardt has leased his electric light plant to Christian Wangsgard, who will operate it from the big dam, four miles from the city. A power house will be built. The improvements will cost several thousand dollars.

Indianapolis, Ind.—The "Sun" states that the Jenney electric plant, destroyed by fire several months ago, will be rebuilt in this city. The company has been capitalized at \$100,000 and \$70,000 has been taken.—At a meeting of the shareholders of the Citizens' Street Railway Company of this city, held in Philadelphia on the 30th ult., the resignation of President Kennedy Crossan was received and accepted. Vice-president W. W. Kurtz also presented his resignation, but at the request of the shareholders it was withdrawn. Mr. Kurtz will act as president for the present.

Jamaica, L. I., N. Y.—The Queen's County supervisors have granted a franchise to the New York & North Shore Railroad Company to lay its rails over several of the county roads in the towns of Newtown and Flushing and over the Little Neck bridge. All the necessary permits have now been obtained and the company, which is an allied organization of the New York & Queens County line, will at once extend its line from College Point to Whitestone, Willets Point and Manhasset, and from Flushing to Jamaica Village through Hillside avenue to Richmond Hill, thence to Middle Village, and there it will connect with the Calvary Cemetery line to Long Island City. A continuous line will thus connect Long Island City, Newtown, Flushing and Jamaica.

Jamestown, N. Y.—Much interest is manifested again in the project to build a railway from Mayville in this county to Warren, Pa., to pass through the villages of

Panama, Grant, Sugar Grove and other smaller settlements. Representatives of Eastern capitalists who were present at a meeting held a few evenings ago at Panama stated that if the right of way could be secured on reasonable terms there would be no doubt as to the building of the road during the coming summer.

Kansas City, Mo.—Jacques Morgan, city electrician, has submitted a report to the aldermen placing the cost of a 225 lamp plant, exclusive of the site, at \$99,640. The plant would be a 375 lampstation of three dynamos, as it is necessary to have one dynamo in reserve in case of accidents to the others. The most expensive item is the 225 miles of wire necessary for 225 lamps. The cost of this is estimated at \$70,125. There are now 211 arc lights in use by the city at \$110 a year for each lamp, or a cost of \$23,210 each year for Kansas City's street lights. Mr. Morgan thinks the cost of a city plant too great to make it practicable.

Lake Charles, La.—The Lake Charles Street Railway Company have decided to equip their lines with electricity, and will probably use the storage battery system.

Lancaster, Pa.—William B. Given of Columbia, receiver of the Pennsylvania Traction Company, has just assumed the duties of general manager of all the lines controlled by him. The office of superintendent of the lines centering at Lancaster and Columbia having been abolished, Frank S. Given has been appointed assistant general manager with headquarters at Lancaster, and he will fulfil the duties of superintendent of all the lines.

Lincoln, Neb.—The Lincoln Traction Company, the successor of the old street car company, is now in full possession of the street railway system of this city. The officers of the company are: Manager, Brad D. Slaughter; superintendent, J. H. Humpe; superintendent of motive power and construction, H. C. Hartley; cashier, E. B. Ransom; assistant cashier, Norman Belcher.

Marinette, Wis.—The Marinette & Menominee Electric Company, which has been organized here with a capital stock of \$200,000, proposes to improve the power at Chippie Rapids, on the Menominee River, and furnish power to street railways and a paper mill. The improvement will cost \$150,000. The incorporators of the company are Isaac Stephenson and John Spalding, of Chicago; Fred Carney, Sr., A. C. Merriman, F. M. Brown, H. C. Higgins and G. W. Hanley, of Marinette, and Edward, Daniel and August Spies and S. M. Stephenson, of Menominee, Mich.

Milwaukee, Wis.—The "Wisconsin" says: "On the additional new lines and extensions to the present system under control of the Milwaukee Electric Railway & Light Company, that company will expend in the neighborhood of \$300,000. This will include the line from North Greenfield to Waukesha, and one from the northern city limits to Whitefish Bay, via (Oakland avenue); also for the College and Country Club line, from Folsom place on Glen avenue to Mineral Spring road, a half mile north of the city limits. There will be, in addition to these entirely new routes, several extensions of present city lines, including that on Vliet street to West Park. The company will also expend \$500,000 or \$600,000 on its new power house and machinery, all of which will be laid out early in the year. For the improvements already decided on and assured, the expenditures during the first six months of 1898 by the street railway company will be in the neighborhood of \$1,000,000."

Mystic, Conn.—The committee on new enterprises of the local board of trade have nearly completed plans for establishing an electric power plant at Mystic. It is proposed to do business under the charter granted by the General Assembly in 1893 to Solomon Lucas of Norwich, Francis M. Manning of Mystic, and George D. Whittlesey (deceased) of New London, under the name of the Mystic Electric & Gas Light Company. The committee visited Norwich and conferred with Mr. Lucas and satisfactory arrangements for the use of the charter were made. Mr. Lucas will be one of the shareholders in the company.

New York.—The talk of changing the motive power of the Manhattan Elevated Railroad to electricity has lately assumed a certain earnestness among those pecuniarily and politically interested in the road that promises practical results. If some reliable electrical system is found for the operation of the road, the change would be hailed with delight by every citizen of the metropolis.

Norwich, Conn.—E. P. Shaw, Jr., formerly general manager of the Norwich street railway, is now manager of the system of trolley lines that is to connect Newport with Fall River and is hard at work making preparations for the building of the road. The work of construction will begin at once, in order to have the line in operation by next June.

Phoenix City, Ga.—A prominent local capitalist is at the head of a movement here for the establishing of an electric plant to supply light for the city and for private uses.

Philadelphia.—The Union Traction Company's new power house, built on the site of the one which was destroyed by fire in March last, is now about completed. The new machinery embodies all the latest improvements and the capacity of the plant has been increased. The switchboard is constructed throughout of white marble slabs on a framework of steel, and is double decked. It occupies the entire Mt. Vernon street end of the engine room and is probably the largest railway switchboard in the world, excepting one recently constructed in Chicago. It is equipped with the very latest type of instruments, and in this respect is considered unequalled in convenience and efficiency.

Placerville, Cal.—The Placerville "Nugget" states that C. S. Young, president of the Pacific Coast Electric Power & Construction Company, has taken the contract to build a line sixty-eight miles long, for the purpose of conveying electric power to Fresno. This will be the longest line of the kind ever built.

Quincy, Ill.—A local inventor is working on a fire engine which will be run by electricity, both at fires and en route to fires. He has not yet perfected his engine and refuses to give a description of it to the public until he is further along with it. The engine, he says, will be much lighter than the steam fire engines.

Rockford, Ill.—The car barn of the City Railway Company was destroyed by fire on the 28th ult. Two cars, eleven motors, practically all the summer supplies and equipment, together with valuable tools, were lost. The total loss is about \$8,000. The company carries an insurance of \$30,000.

Savannah, Ga.—The municipal lighting scheme which had gained some headway here has fallen through, the council having passed a resolution giving a five years' contract to the Brush Electric Light & Power Company at \$72 per light per annum.

Seranton, Pa.—The Hubbell Electric Lamp Company is now operating a plant here for the manufacture of an electric bicycle lamp patented by C. J. Hubbell, which the company claims is the first perfect lamp of the kind put on the market. The lamp is also applicable to mine working.

Washington, D. C.—The District Commissioners have returned to Congress without their approval the bill proposing that new franchises to street railroads be sold at public auction. The Commissioners say: "The bill proposed requires that the right to occupy public space in the District of Columbia for street railway purposes shall be sold at public auction to the highest bidder. The Commissioners are unable to recommend favorable action upon this measure. In recent years Congress in granting charters to street railway companies in the District has required the companies to pay 4 per cent. of their earnings as taxes. It seems to the Commissioners that it is a much better plan to require, by law, the companies to pay for their privileges in a fair percentage of their gross earnings than to leave the matter to the uncertainties of a public auction, where an absurdly low price or an excessive one may be bid, to the disadvantage of the Government in one case, or of the company in the other, neither of which is desirable for the public good."—A bill has been introduced in the House by Mr. Wheeler of Alabama authorizing the construction of an electric power station on the Tennessee River. The bill gives W. G. Douglas, G. H. Van Wagner, Harry Mitchell, Nial C. Elting, William Ozden and T. H. Allen permission to erect and operate a power station on the Tennessee river, and to build and operate dams at points on Muscle Shoals and Colbert Shoals which are unsuitable for navigation.

Weedsport, N. Y.—J. D. Edwards has purchased of C. C. Adams & Sons the Van Marter malthouse property and will commence the erection of a power house for his electric light plant as soon as the weather will permit.

Weston, O.—The council has decided to submit the question of obtaining an electric light plant for the town to a vote of the people. No date was set for the election, but it will doubtless be held soon.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—Open competitive civil service examinations will be held at various places in the State on January 29, for positions in the State service. Among other positions is that of assistant electrical engineer.

Bath-on-the-Hudson.—George Shont, electrician for the Central-Hudson Railroad, has resigned and will accept a position with the Hall Signal Company of New York. Charles Dorr of Troy will take Mr. Shont's place on the Central-Hudson Railroad.

PERSONAL AND MISCELLANEA.

M. S. Robison, lately receiver of the Consolidated Street Railway of Fort Wayne, Ind., is said to have accepted a lucrative position as manager of a Chicago street car line and will remove to that city.

W. O. Smith, superintendent of the Louisville (Ky.) Electric Light Company, was presented on New Year's day with a handsome gold badge by the employees of the company.

A press dispatch from San Francisco states that W. K. Burkholder of that city has gone to Alaska to erect an electric plant to operate an electric road over the Chilkoot Pass. Electricity will be generated at Dyea and transmitted twenty miles to the point where it is to be used. At the pass the telegraph system will be used. In addition to the electric wires, the poles will support cables from which heavy cars will be suspended. The motors will be stationary and the cars will be propelled up the incline by cables on a drum. The machinery has already been shipped and the plant is expected to be in working order in about three months.

The St. Louis "Republic" says: "Georges Apostoli, the noted French physician and surgeon, writes to a brother medico in St. Louis that he has discovered the secret of preventing the evil effects which usually ensue from the application of the X ray. He says that he simply connects the machine with the ground by a metallic circuit. Under that system he has turned the X ray upon hundreds of patients and not once has there been any deleterious effects from the rays. None of the burning, itching sensations which are commonly ex-

perienced have been apparent when the machine used by Dr. Apostoli was in use. According to the noted Frenchman, all that is needed to eliminate the baneful influences of the ray is a connection with the ground in order to complete the circuit."

The marriage of Prof. Alexander Melville Bell, the father of Alexander Graham Bell, the inventor of the telephone, to Mrs. Harriet G. Shibley, a Canadian lady many years his junior, was an event of special interest on account of the age of the bridegroom and the somewhat romantic manner in which the marriage was brought about. A photograph of the lady attracted the attention of the professor, who sought an introduction, was charmed, proposed and was accepted, all within a few months. The wedding took place in New York on the 1st inst., and among those in attendance was the son of the bridegroom, Alexander Graham Bell, and a brother, D. C. Bell. Prof. Bell was born in Edinburgh, Scotland, March 1, 1819. For twenty-two years he was a lecturer at Edinburgh University and at New College. Later he lectured in the London University, and in 1870 came to Kingston, Canada, and lectured in Queen's College in that place. In 1881 he removed to Washington, where he has since lived. He is author of several treatises on elocution. His wife is twenty-five years his junior.

The city council of Joliet, Ill., recently granted a fifty-year electric light and power franchise to Col. John Lambert, who soon after sold the grant to the Economy Light and Power Company for \$30,000, a proceeding which caused a great deal of ugly talk and criticism of the council. Those who indulged most freely in this are now wearing sackcloth, for Mr. Lambert, who is one of the most generous and most enterprising of the citizens, has donated the entire sum to the city with the stipulation that \$3,000 be divided equally between two hospitals and the remaining \$27,000 be applied to the erection of a city hall and library building.

A Denver paper states that a company is being organized to develop the resort features of Ute Pass. At present there is a chain of finely constructed hotels running from Cascade to Woodlawn Park. The new company proposes to develop the resources of the canon by constructing an electric light plant to be run by water power which is now going to waste and to use the overflow from a small dam across one of the canons for an artificial waterfall to be illuminated at night by means of colored lights. During the past summer an expert landscape artist visited the pass and suggested the general outline of the scheme, which is nominally the making of an immense park about seven miles in length. The electricity generated at the one plant will be sufficient to furnish lights for all the hotels as well as a number in the grounds surrounding each. With the scheme as originally suggested carried out, the State would have a veritable electric park supplied with light and beautiful water effects from the abundant water falls in the vicinity.

RECENT COMPANY ELECTIONS.

Cleveland and Chagrin Falls Electric Railway Company, Cleveland, Ohio.—President, V. A. Taylor; vice-president, M. A. Sprague; secretary, Charles Lane; treasurer, William H. Prescott; general manager, L. M. Coe; directors: F. D. Carpenter, L. M. Coe, W. H. Prescott, R. L. Palmer, B. A. Taylor, J. E. Emsien, C. Lane, F. M. Stearns, M. A. Sprague and C. C. Morgenthau.

Skowhegan and Norridgewock Electric Railway & Power Company, Skowhegan, Me.—President, R. W. Brown; clerk, Turner Buswell; directors: R. W. Brown, A. F. Gerald, A. H. Weston, J. P. Clark and L. C. Emery.

COMMERCIAL PARAGRAPHS.

We are in receipt of a new edition of the catalogue issued by the Hazleton Boiler Company, 716 East Thirteenth street, New York City. This book, entitled "The Generation of Power," is fully illustrated and contains any amount of useful information, including numerous tables, extremely convenient for any one engaged in the designing and proportioning of boilers. The catalogue, containing 150 pages, is well worth having and can be obtained by applying to the Hazleton Boiler Company at the above address.

We desire to acknowledge the receipt of an extremely attractive calendar sent us by Alfred F. Moore, the well-known manufacturer of Insulated Electric Wire and Cables, 200 North Third street, Philadelphia.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, acting gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

Beauty, utility and value are happily combined in Hood's Sarsaparilla Coupon Calendar for 1898, kindly sent us by the company. The lovely child's head is in an embossed gold frame, surrounded by sprays of flowers in mosaic, the harmonious pad in blue with clear figures, and the coupons by means of which many valuable books and other articles may be obtained, make up the most desirable calendar of the kind in print. The first coupon article is Hood's Practical Cook's Book, a handsome, useful volume of 850

pages. Ask your druggist for Hood's Coupon Calendar, or send 6 cents in stamps for one to C. I. Hood & Co., Lowell, Mass.

Armortite Interior Conduit is now generally recognized by architects and contractors as the standard for all high grade interior work. This conduit as it is now made with the light steel wall and light lining is superior to the old style heavy conduit and is displacing entirely the old type of tubing. The Electric Appliance Company are carrying a large stock of light wall steel Armortite in Chicago and are doing a handsome business on the same. They claim that Armortite is easier to install than any other conduit that has yet been placed on the market.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

The Excelsior Carbon Paper Manufacturing Company, 301 Broadway, New York, in their holiday greeting, issued for distribution, thank their friends for past favors and hope they have merited a continuance of the generous patronage they have received. They desire to call attention to the fact that they have added several special carbons to their already extensive line, and will be pleased to submit samples.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

INCORPORATIONS.

The New York & Staten Island Electric Company has filed with the Secretary of State a certificate of increase of capital stock from \$500,000 to \$1,500,000. The debts and liabilities of the company aggregate \$72,514.

The Marysville Electric Light, Heat & Power Company, Marysville, Perry County, Pa.,—to supply the borough of Marysville with electric light, heat and power. Capital stock, \$10,000. Directors: John A. Herman of Harrisburg, Harry M. Hoover and J. W. Beers of Marysville.

The Kerrville Electric Light, Heat & Power Company, Kerrville, Kerr County, Tex.,—to manufacture and supply electric light, heat and power to citizens of Kerrville. Incorporators: Charles Schreiner, A. C. Schreiner and L. A. Schreiner.

The Jordan River Electric Generating Company's stockholders have voted to increase the capital stock to \$1,000,000 and change the name to the Salt Lake City Water & Electric Power Company. The company is sponsor for the plan to establish a power plant in the Jordan narrows and furnish power for Mercur and Bingham, Utah. Allan G. Lamson is president and C. W. L. Stevens secretary of the company.

The Hudson River & Long Island Sound Railway Company, New York City—to construct a street surface road in Westchester County, N. Y., from Yonkers to Pelham Manor. Capital stock, \$100,000. Directors: Charles O. Bissett, of Washington; Henry A. Welch, of Detroit; James F. Secor, Jr. of Pelham Manor; D. B. Halstead, Paul Gorham and John H. Sed, of Brooklyn, N. Y.; Seward Baker and Walter R. Quick, of New York City, and William L. Stout, of Elizabeth, N. J.

The A. D. Scott Manufacturing Company, Chicago—to manufacture electrical goods. Capital stock, \$25,000. Incorporators: Ashley D. Scott, Samuel S. Scott, Watson B. Farr, all of St. Louis, Mo.

The West Orange Electric Light & Power Company, West Orange, N. J. Capital stock, \$10,000, and \$1,000 is to be used to begin business with. Incorporators: Frank Brewer and Albert P. Condit of West Orange, John O'Rourke of Orange, Jay Ten Eyck of Newark, Alfred P. Skinner of Franklin, and James C. O'Brien of South Orange.

The Manhattan Electric Company, St. Louis, Mo. Capital stock, \$1,000. Incorporators: Elliott Jones, A. E. Bochenstein and G. J. Percival.

The Viking Bicycle & Electric Motor Company, Toledo, O.—to continue the manufacture and sale of bicycles now carried on by the Union Manufacturing Company and in addition take up the manufacture and sale of electric motors and horseless carriages. Capital stock, \$100,000. Incorporators: Alvin Peter, George W. Birchall, Fred Cranston, Arthur J. Cone and Guy W. Kinney.

The Rochester Electrical Manufacturing Company, Rochester, N. Y.,—to manufacture electrical devices, inventions, appliances and attachments. Capital stock, \$50,000. Directors: J. Miller Kelly, Louis W. Miller and William E. Werner, Rochester.

The Colonial Electric Company, New York—to furnish light and power by means of electricity in Greater New York. Capital stock, \$25,000. Directors: Garrett S. Odell and Orin H. Cheney, New York, and Horace S. Andrews, Brooklyn.

The Saranac Lake Light, Heat & Power Company of Franklin and Essex Counties, N. Y.—to acquire the franchises of the Saranac Lake Electric Light Company. Capital stock, \$100,000. Directors: Frederick A. Isham and Charles S. Stackpole, New York City; Orlando Blood, Wallace Murray and Percy A. Gould, Saranac Lake,

A Highly Successful Independent Telephone Company.

A special dispatch in the Detroit Journal from Ishpeming, Mich., dated December 28, conveys information that will not fail to please all friends of independent telephone enterprises. It is as follows:

"The Marquette County Telephone Company, with headquarters in this city [Ishpeming], announces a dividend of ten per cent. to be paid the first of the year. This has been accomplished within two years. The original cost has been exceeded by one-half, due to the increased business secured, requiring a far greater number of telephones than was at first thought could be rented. The total investment is now something like \$35,000, and stock that was issued at \$100 per share is now worth \$135 per share. There are few sellers at this price. The system is one of the best in the country. Nearly 800 'phones are now in use in the county and the business of the Bell company has been practically captured in all of the towns with the exception of Marquette, where, by giving 'phones free and other concessions, it has managed to retain between 200 and 300 subscribers. In the city of Ishpeming, the most populous and prosperous in the county, there are but three Bell 'phones, and these are being furnished rent free. The Marquette Company has paid for all its equipment, and begins the new year without owing a dollar."

The construction of the transcontinental telegraph line in Africa, which began at Blantyre in 1896, had at last reports reached a point 85 miles beyond Fort Johnson, at the southern end of Lake Nyassa. There are at present seven white men working on the construction, in addition to two survey parties. One of these has just completed the survey to Kotakota, and the other has commenced from Bandawe. Another party of six white men has commenced to work from Karonga toward Tanganika, and arrangements have been made to complete the line along the west side of Lake Tanganika, and across to Uganda. The magnitude of this operation will be appreciated when it is pointed out that a hundred tons of material is required for only 150 miles of line, and every thing has to be transported across the country in primitive fashion.

The Onancock Telephone Company has been organized at Onancock, Va., with the following officers: E. E. Miles, president; Dr. John W. Kellam, vice-president; John W. Rogers, secretary and treasurer. The directors are E. E. Miles, John W. Kellam, W. A. Burton, Spencer F. Rogers, Julius J. Belote, Charles F. Rogers, H. R. Boggs, and John W. Rogers. The line will connect Onancock with a number of villages on the seaside and bay. The old line connects Onancock with Accomac Courthouse, from which the recently organized Hall Telephone Company will run a line through the northern part of Accomac, connecting all the towns and villages in that region.

The telephone line connecting Leighton, twelve miles east of Tusculumbia, Ala., with Florence, Sheffield and Tusculumbia has been completed and is now in operation. It is thought that it will not be a great while until Riverton, Dickson, Cherokee, Borton and Pride will also be connected by a line reaching from Riverton to Tusculumbia, a distance of about thirty miles, when all of the principal towns in the county will be connected with Tusculumbia and Sheffield.

A Baltimore dispatch states that on the 6th inst. successful telephonic communication under water was established between Simon Lake's submarine boat Argonaut and points in Baltimore and Washington. Everything worked admirably. The vessel was run out into the Patapsco river with about 1,200 feet of cable attached. While she was under water those aboard were in direct communication with Washington, the Mayor's office in Baltimore and several other points. With the arrangement now on board the boat could go into any harbor or within reasonable distance of any telephone line and form a connection with the central system.

At Atlanta, Ga., the board of electrical control has passed favorably upon the plans for the underground work of the Standard Telephone Company. With these plans approved the Standard people say the work of laying conduits will commence at once. Some work has already been begun. The new company is bound by its contract to put in 1,000 telephones ninety days from the time work is commenced. President Baer says this will easily be done, and he says he will soon have 4,000 'phones operating in Atlanta.

A special cable dispatch to the N. Y. Sun from Berlin, Ger., states that the annual charge of \$37.50 for telephone service in that city will in future be replaced by a yearly rent of \$12.50 for the apparatus plus the small charge of one pfennig (about one fourth of a cent) for each conversation by private persons, two pfennige for business men and

firms and three for clubs, cafes, etc. Business men are strenuously opposed to the proposal that they be charged more than any others.

The Northwestern Telephone Company has notified the State Treasurer of Minnesota that it will not pay the 3 cent tax on business passing to or from the State through other States, because it is interstate business. The company returns the first report on the business done in the State which State Treasurer Koerner at one time rejected. The report gives the business done in Minnesota by the company at \$334,000.

A snowstorm of unusual violence visited Pittsburg, Pa., on the last night of the old year. The principal sufferers were the telegraph and telephone companies, whose lines were prostrated in nearly all parts of the city and in the outlying country. The Central District & Printing Telegraph Company's damages by the storm are estimated at \$80,000.

The Home Telephone Company had another setback at the last meeting of the board of aldermen in New Brunswick, N. J. A motion to refer its application for a franchise to the street and railroad committee was adopted by a vote of ten to three. This delays action for a month at least, with the probability of shutting out the Home Company entirely.

A press dispatch from Freehold, N. J., states that a new telephone line in opposition to the Bell system is in course of erection throughout Monmouth County. The circuit, when completed, will take in Keyport, Red Bank, Freehold, Matawan, Holmdel, Middletown, Atlantic Highlands and intermediate places. The rates will be only about one-half those charged by the Bell company.

A Cheyenne, Wyo., dispatch of the 29th ult. states that the Uintah-Rich Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of \$5,000. The line is to be built between Evanston, Wyo., and Randolph, Utah. The incorporators are Chas. Kingston, J. E. Cashin, Charles Stone of Evanston, Robt. McKinnie of Randolph, Utah, and J. M. Baxter of Woodruff, Utah.

Richmond, Va., by connecting with the exchange in Manchester, just across the river, is enabled to use the long distance telephone and thus communicate with all the great commercial cities of the country. The long-distance telephone company has been unable to get a franchise in Richmond.

The Clay County Telephone Company at its annual meeting at Clay Center, Neb., recently, declared an annual dividend of 10 per cent. The following officers were elected: President, L. C. Hurd, Harvard; vice-president, C. J. Furer, Fairfield; secretary-treasurer, J. F. Eller, Harvard.

Harry Inks of Ligonier and B. F. Leiser of Albion have been granted a franchise by the Commissioners of Noble county, Ind., to construct a telephone line connecting Kendallville, Brimfield, Rome City, Avilla, Ligonier, Wawaka, Kimmel, Cromwell and Albion.

The Norristown, Pa., Times says the Phoenixville Telegraph & Telephone Company will change its name to the Chester County Telegraph & Telephone Company and will operate in Montgomery, Chester and Delaware counties, Pa.

Among recent visitors to Chattanooga, Tenn., according to the "Times," was O. Rex, of North Manchester, whose mission was to organize a new telephone company and operate a new telephone system in Chattanooga.

A telephone line is to be erected between DeLand and DeLeon Springs, Florida.

New Companies Incorporated.

The Business Men's Telephone Company of Nunda, Livingston County, N. Y. Capital stock, \$5,000. Directors: L. A. Walker, Nunda; H. C. Farnum, Oakland; Robert Bennett, Short Tract; V. E. White, Granger; George Campbell, East Koy; John Myer, Lamont, and S. G. Clute, East Koy.

The Nicholasville Telephone Company, Nicholasville, Ky. Capital stock, \$10,000. Incorporators: H. B. Lancaster and others.

The Baltimore, Annapolis & Drum Point Telephone Company, Baltimore. Capital stock, \$12,500. Incorporators: George Weems, William and Frank R. Biedler, John B. Gray, William H. Hellen and others.

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

Digitized by Google

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.							
		Authoriz'd	Issued.						Authoriz'd	Issued.										
New Bedford Mass.—Jan. 10:																				
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '97.	...	158	Boston, Mass.—Jan. 10:													
							American Bell Telephone Co.....	100	50,000,000	25,000,000	4% Q., Oct., '97	268	269							
							Erie Telegraph & Telephone Co.....	100	.....	.....	1% Q., Aug., '97.	72 1/2	72 3/4					
							New England Telephone Co.....	..	10,894,000	10,894,000	\$1.25 sh., Q.	128	130							
Northampton, Mass.—Jan. 10:																				
Northampton Street Ry.	100	800,000	225,000	5% A., July, '97.	165	170	New York.—Jan. 10:													
							American Telegraph & Cable Co....	100	14,000,000	14,000,000	1% Q.	90	92							
							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1% Q.	104	106							
							*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	180	180 1/2							
							Franklin Tel. Co.....	100	1,000,000	.....	1% S.	40	44						
							Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q., Aug., '97.	72	72 1/2							
							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	.....	1% Q.	107 1/2	110						
							*International Ocean Tel. Co. guar 6%	100	8,000,000	.....	1% Q.	107 1/2	..						
							Mexican Telephone Co.....	100	2,000,000	.....	.....	50	50					
							*New York & New Jersey Tel. Co..	100	5,000,000	8,722,000	1% Q., July, '97.	150	151							
							*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	.....	2% S.	70	76						
							*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	99	101							
							*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2% S.	89	95							
							*Commercial Union Telegraph Co..	25	500,000	500,000	2% S., July 1 '97.	117	..							
							Western Union Telegraph Co.....	..	.....	97,870,000	1% Q., Oct., '97.	92 1/2	92 3/4					
							*Div. guar. by Postal Tel. Co.	..	.....	.....	.....	..	..	
Philadelphia.—Jan. 10:																				
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000	2,000,000	14 1/2	..	Miscellaneous.—Jan. 10:													
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2% Q., July 15, '97.	..	45	American Dist. Tel. (Phila.).....	25	400,000	.....	.....	14	..					
Hestonville, Man. & Fairmount.....	50	533,900	533,900	2% Q., July 15, '97.	..	50 1/2	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	174	175							
Fairmount Pk. & Had. Pass. Ry.....	50	800,000	800,000	3% Feb. 1, '97.	60	..	Cheapeake & Potomac Tel. Co..	100	.....	.....	.....	67	69				
Union Traction Co.....	30	30,000,000	5,986,095	.....	18 1/2	..	Chicago Telephone Co.....	100	.....	.....	.....	200	202			
Electric Traction Co.....	50	8,297,920	8,297,920	.....	71 1/2	..	Central Dist. Frtg. & Tel. Co. (Phg.)	100	750,000	750,000	.....	..	..				
d'Oliver's Passenger Ry.....	50	500,000	.....	.....	285	290	Empire & Bay States Telegraph Co..	..	.....	.....	.....	52	78	
d'Frankford & Southwark Pass. R.	50	1,187,500	.....	.....	370	..	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	64	66					
d'Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	89	90 1/2	*Northwestern Telegraph Co. guar	50	2,500,000	2,500,000	2% Q.	110	115					
d'Lehigh & South Street Ry.....	25	1,000,000	1,000,000	.....	89	90 1/2	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	85	..			
d'Second & Third Streets Ry.....	50	1,000,000	1,000,000	.....	89	90 1/2	Southern New Eng. Teleph. Co.....	100	8,000,000	.....	.....	120	122				
e'People's Traction Co.....	50	10,000,000	1,771,076	\$9 share A., Mar. 97	245	..														
e'Green & Oates Passenger Ry.....	50	1,500,000	1,600,000	3% A., April, '97.	181	..														
e'Green & Oates Passenger Ry.....	50	500,000	1,572,800	\$5.25 share—1897.	135	..														
e'People's Passenger Ry.....	25	1,500,000	150,000	3% July, 1897.	135	..														
e'People's Passenger Ry.....	25	750,000	174,000	.....	66	66													
e'Philadelphia Traction Co.....	50	30,000,000	1,277,402	.....	79 1/2	79 3/4													
e'Outhine & Bainbridge St.....	50	1,000,000	20,000,000	4% S.—Apr. 1, '97.	..	140														
e'Continental Pass. Ry. guar.....	50	1,000,000	140,000	6% A.—Mar., '97.	..	140														
e'Empire Passenger Ry. Co.....	50	600,000	580,000	\$6 share—July, '97.	..	140														
e'Philadelphia City Pass. Ry.....	50	1,000,000	1,600,000	.....	..	140												
e'Philadelphia & Gray's Ry. RR.....	50	1,000,000	1,475,000	\$7.50 share July '97	176 1/2	180														
e'Ridge Avenue Passenger Ry.....	50	750,000	298,650	\$3.50 share July '97	87	..														
e'Philadelphia & Darby Ry. guar.....	50	1,000,000	1420,000	\$12 share, July '97.	2.2	..														
e'17th & 19th Sts. Pass. Ry. guar.....	50	1,000,000	1,200,000	\$2 share July, '97.	..	..												
e'Thirtieth & 15th Sts. Pass. Ry.....	50	1,000,000	1,250,000	1% S., July, '97.	157 1/2	..														
e'Union Passenger Ry. Co.....	50	1,500,000	1,335,000	\$11 sh. A., July, '97	282	..														
e'West Philadelphia Pass. Ry.....	50	750,000	1,900,000	\$9.50 shre, July '97	225	225														
Rochester, N. Y.—Jan. 10:																				
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	17	20													
Reading, Pa.—Jan. 10:																				
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an., Jan. & July, '97.	10	15														
e'City Passenger Ry.....	50	350,000	850,000	.....	111	..													
e'East Reading Electric Ry.....	50	1,000,000	1,000,000	.....	80	..													
St. Louis Mo.—Jan. 10:																				
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..											
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1888.	..	..												
Lindell Ry.....	100	2,500,000	2,400,000	1% Q., July, '97.	124	126														
National Railway Co.....	..	2,500,000	2,479,000	1% Q., July, '97.	..	..												
Cass Avenue & Fair Grounds.....	..	2,500,000	2,500,000	.....	..	..											
Citizens' RR.....	100	2,000,000	1,500,000	1% Oct., '93.	90	110														
St. Louis RR.....	100	2,000,000	2,000,000	2% Q., July, '97.	100	105														
Missouri RR.....	50	2,400,000	2,300,000	1% Q., July, '97.	165	175														
People's RR Co.....	50	1,000,000	300,000	50c. Dec., '89.	..	..												
Southern Electric Ry.....	50	500,000	500,000	.....	50	52													
Southern Electric Ry.....	100	1,000,000	1,000,000	3% S., Jan., '96.	100	101														
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	48	50													
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '96.	..	175														
San Francisco, Cal.—Dec.																				
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	108 1/2	109 1/2														
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50														
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	52 1/2														
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	6	8													
Scranton, Pa.—Jan. 10:																				
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	7 1/2	10													
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	.....	15	..													
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	.....	9	11													
Springfield Ill.—Jan. 10:																				
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11												
Springfield O.—Jan. 10:																				
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2												
Springfield, Mass.—Jan. 10:																				
Springfield Street Ry.....	100	1,200,000	1,000,000	8% A.	205	210														
Toronto Canada.—Jan. 10:																				
Toronto Ry. Co.....	100	6,000,000	6,000,000	1% Q., S.	90 1/2	90 1/2														
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	242	..														
Washington, D. C.—Jan. 10:																				
Belt Ry. Co.....	50	500,000	500,000	.....	..	..											
Capital Traction Co.....	100	12,000,000	12,000,000	50c. per sh., Oct. '97.	61	62														
Columbia Ry. Co.....	50	400,000	400,000	5% A.	63	68														
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	..	..											
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	..	..											
Metropolitan RR Co.....	50	1,000,000	437,130	2 1/2% Q.	120	..														
Worcester, Mass.—Jan. 10:																				
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	16 1/2	18													
*Worcester Traction Co.....	100	2,000,000	2,000,000	3% S., Sept., '97.	95	97														
Worcester & Suburban Street Ry.....	100	550,000	512,500	4%, 1896.	85	..														
Wilkesbarre, Pa.—Jan. 10:																				
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29														

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10% guaranteed by Reading Traction Company.
 n Dividend of 6% guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Jan. 10:											
Fort Wayne Electric Co.....	25	.....	.....	.....	..	..	..	..	..	..	..
Ft. Wayne Elec Co. T. Sec. Series A.....	100	40,000,000	30,460,000	2% Q., Aug., 1898.	85 1/2	85 1/2	..	..	..	..	..
General Electric Co.....	100	10,000,000	4,252,000	8 1/2% S., July, '98.	85	87	..	..	..	..	..
T. H. Elec. Co. T. Secur., Series D.....	50	.....	.....	.....	8 1/2	8 1/2	..	..	..	..	..
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	24 1/2	25	..	..	..	..	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,088	1% Q., Oct., '97.	58	..	..	..	..	..	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	..	..	..	..	..	..	..
New York.—Jan. 10:											
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	127 1/2	130	..	..	..	..	..
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2% Q., Oct., '97.	104	105	..	..	..	..	..
Edison Ore Milling Co.....	100	.....	.....	.....	..	..	..	..	..	..	..
Edison Electric Storage Co.....	100	.....	.....	.....	..	..	..	..	..	..	..
General Electric Co.....	100	40,000,000	30,460,000	2% Q., Aug., 1898.	85 1/2	85 1/2	..	..	..	..	..
General Electric Co.....	100	10,000,000	4,252,000	8 1/2% S., July, '98.	85	87	..	..	..	..	..
Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	..	..	..	..	..	..
United Elec. Lt. & Pow. Co.....	100	.....	.....	.....	..	..	..	..	..	..	..
Pittsburg, Pa.—Jan. 10:											
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	..	..	..	..	..	..
East End Electric Light Co.....	50	800,000	800,000	Q	..	10	..	..	..	..	..
Philadelphia, Pa.—Jan. 10:											
Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	..	..	..	..	..	..
*Electric Storage Battery Co. com.	100	8,500,000	.....	.....	28 1/2	29 1/2	..	..	..	..	..
*Electric Storage Battery Co. pfd.	100	5,000,000	.....	.....	81 1/2	82	..	..	..	..	..
*Penna. Ht. Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	19	19 1/2	..	..	..	..	..
*Penna. Ht. Lt. & Pow. Co. pfd.	50	5,000,000	.....	6% Oct., '97.	41 1/2	45	..	..	..	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	18 1/2	14	..	..	..	..	..
Southern Elec. Light & Power Co..	10	187,500	187,500	.....	10	..	..	..	..	..	..
Miscellaneous.—Jan. 10											
Brush Electric Co.....	50	.....	.....	.....	..	..	..	..	..	..	..
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	82 1/2	85	..	..	..	..	..
Edison Illg. Co. (St. Louis).....	100	.....	.....	.....	..	..	..	..	..	..	..
Eddy Electric Mfg. Co.....	25	.....	.....	.....	..	17	..	..	..	..	..
Hartford (Conn.) Elec. Light Co.....	100	350,000	.....	.....	118	125	..	..	..	..	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	.....	.....	4 1/2	..	..	..	..	..	..
New Haven (Conn.) Elec. Lt. Co.....	100	100,000	.....	.....	148	..	..	..	..	..	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	2% Q., Oct., '96.	82	83	..	..	..	..	..
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	114	118	..	..	..	..	..
Royal Elec. Co. (Montreal).....	..	1,000,000	.....	2% Q.	* 142	143	..	..	..	..	..
Toronto (Canada) Elec. Light Co.....	100	1,085,000	1,085,000	1 1/2% Q.	* 136	136 1/2	..	..	..	..	..
Thomson-Houston Welding Co.....	100	.....	.....	3% S., Dec. 1, '96.	90	100	..	..	..	..	..
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	90	100	..	..	..	..	..
*ex d.											

PASSENGER RAILWAY.

*With interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Jan. 10, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	104	106
Missouri R.R. Co.....1st mtg. 5s.	1,000,000	700,000	1916	M. & S.	104	106
Mound City R.R. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's R.R. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	.....	.....
People's R.R. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	.....	.....
People's R.R. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	70	72½
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis R.R. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	102½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	63	66
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	109	111
Union Depot R.R. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103½	104½
Union Depot R.R. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	110	112
†Controlled by St. Louis R.R. Co.						
†Controlled by Union Depot R.R. Co.						
†Controlled by Lindell R.R. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Dec., 1897.						
California St. Cable R.R.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	107	....
Geary St., Park & Ocean R.R.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126	....
†Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	....
†Park & Cliff House R.R.....1st mtg. 6s.	850,000	350,000	1912	J. & J.	.....	101½
†Park & Ocean R.R.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	....
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	115	118
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Jan. 10, 1898.						
Belt Ry. Co.....C.....mtg 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....C.....mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home.....mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan R.R. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Jan. 10, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
†Citizens' St. R. (Ind. polis) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	70	75
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	94	97
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	99½	100
†Crosstown St. Ry. (Columbus, O.) 1st mtg. 5s.	2,000,000	572,000	1933	J. & D.	94½	97½
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	101
Denver Co. Tramway Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	.....	95
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	112	112½
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	89	91
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	116	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	90	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. R.R. Co.						
†\$87,000 in treasury.						
†\$960,000 reserved to redeem prior liens.						
††\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Jan. 10, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	1922	Quar.	154	....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	.....	.....	160½	....
Pittsburg, Pa.						
Date of Quotation—Jan. 10, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light. 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Jan. 10, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	111	....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,160,000	1903	.....	113	....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	110	112
Edison Electric Light (Philadelphia)...	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'y'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Jan. 10, 1898.						
American Bell Telephone. 7s.	.....	.....	1898	F. & A.	100%	104
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	103%	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	.....	.....	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Jan. 10, 1898.						
American Electric Heating. 5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. 7s.	.....	.....	.....	.....	25	.....
*Barney & Smith Car. Co. 7s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	16,000	.....	.....	.....	.....	.....
Unlisted. †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10½@10¾c.; Lake, 10½@11c.; cast, 10½@10¾c.

The North Chicago Street Railway's quarterly dividend of 3 per cent. will be payable January 15.

The Green & Coates Street Passenger Railway, Philadelphia, announced a dividend of \$1.50 per share, payable January 7.

The Citizens' Street Railroad (Indianapolis) earned gross in December \$87,650, an increase of \$10,272 compared with December, 1896.

The Columbus (O.) Street Railway reports for December gross earnings of \$55,495, an increase of \$3,385, and net earnings \$30,481, an increase of \$4,330.

The Chicago Edison Company has made an additional issue of \$400,000 five per cent. first mortgage bonds, making the total amount now outstanding \$2,975,000.

A bill has been introduced in the Ohio Legislature providing for the repeal of the law granting permission to cities to extend street railway franchises fifty years.

The Hestonville, Mantua & Fairmount Passenger Railroad Company (Philadelphia) declared a semi-annual dividend of 3 per cent. on its preferred stock, payable January 10.

The United Traction Company of Pittsburg reports for December, 1897: Gross earnings, \$127,594; operating expenses, \$54,856; net earnings, \$72,648; fixed charges, taxes, etc., \$47,657; surplus, \$24,991.

A dispatch from Columbus, O., states that a mandamus would be brought in the Supreme Court to compel county auditors over the State to list Bell Telephone Company for taxation to full earning capacity.

Judge O'Rourke, in accepting the withdrawal of M. S. Robison as receiver of the Fort Wayne Consolidated Street Railway, and his final report, allowed him but \$6,667 for his services instead of the \$20,000 he demanded.

Foreclosure proceedings have been begun against the Brooklyn & Brighton Beach Railroad Company in the New York Supreme Court by the Central Trust Company of New York, which holds, as trustee, \$500,000 first mortgage bonds on the property.

In order to complete the many improvements contemplated by the Allegheny (Pa.) County Light Company, the capital stock will be increased. At present the stock is \$1,500,000, and it is expected to increase it to \$2,500,000. A meeting for that purpose will be held March 2.

At the annual meeting of the New Orleans Traction Company, held last week, Mr. Seligman, R. M. Walmsley, of New Orleans, and St. John Boyle, of Louisville, were appointed a committee to arrange for a reduction of operating expenses and to effect other economies. Operating expenses amount to over 74 per cent. The old officers were re-elected.

The earnings of the Central Union Telephone Company in 1897 (December estimated) were \$340,787, or more than double the amount needed to cover the interest charge on the entire issue of bonds, including the \$1,200,000 six per cent. first mortgage gold bonds recently issued.

The Boston "News Bureau" of the 10th inst. says: "The Cataract General Electric Company will to-day pass upon plans to install electric towing on the Champlain canal. Since Platt, Hawley & Co. secured the canal electric franchise free from the State its value has increased to \$16,000,000, though no work has been done."

The Akron, Bedford & Cleveland electric line will pay its first dividend January 15. The amount to be paid is 1 per cent. of the capital stock, or \$7,500. The road has been running only two years and to pay a dividend in that time, financiers say, is remarkable. In addition to paying this dividend the road contemplates spending considerable money in improvements along the line.

On the 7th inst. the directors of the Boston Elevated Railroad Co. met for organization and elected the following officers: William A. Gaston, president; William A. Bancroft, vice-president; William Hooper, treasurer; John T. Burnett, secretary and clerk. The executive committee elected were: William A. Gaston, William A. Bancroft, T. Jefferson Coolidge, Jr., James M. Prendergast and Robert Winsor.

The Chicago "Inter Ocean" says the acquisition of the Commonwealth Electric franchise by the Chicago Edison Company "is regarded as a bit of valuable business and along the lines which have characterized the course of the management in endeavoring to secure legitimate control of the electric lighting business in Chicago north of 39th street. A part of this policy has been to make reductions in price and avoid inviting new competition. The Commonwealth franchise is a very sweeping one, giving its owners the right to manufacture and distribute electricity 'for the purpose of furnishing light, heat and power and the transmission of sounds and signals' in all parts of the city."

The Marquette "Mining Journal" says: "Many experiments have been made by chemists in the hope of discovering some process giving greater tensile strength to electrolytic copper, but so far the results obtained have been of a negative character. An experiment of this kind was made at Dollar Bay about a year ago, when several carloads of Montana copper were received at the plant of the Tamarack Osceola Company. Every effort was made to secure good results from the western copper in its course through the wire drawer mandrels, but unsuccessfully, there being the usual difficulties met with because of the lack of cohesiveness, a marked characteristic of Lake copper, but which is lacking in the metal when secured by its precipitation through the use of the electric current. Further tests have since been made but the results so far secured are not encouraging."

The following appeared in the financial columns of the "Sun" yesterday: "Kessler & Co. offer at par \$250,000 of the 8 per cent. preferred stock of the Electric Vehicle Company. The authorized capital stock of the company consists of \$5,000,000 preferred stock and an equal amount of common. Of the preferred stock only \$60,000 have already been issued. The proceeds of the present offering, which is underwritten by a syndicate, is to be expended for expanding the company's plant, and no part of it for patents or franchises. The earnings of the company in excess of 8 per cent. upon the preferred stock and the same upon the common are to be divided between the two classes outstanding, pro rata. One share of full paid, non-assessable common stock will, under the terms of the present offering, be given to each subscriber to a share of the preferred stock."

The Brooklyn "Eagle" states that holders of Kings County Traction Company stock have received the following communication from J. & W. Seligman & Co.: "Notice to stockholders Kings County Traction Company: We have sold, in connection with other large shareholders, more than a majority of the stock of the Kings County Traction Company at the price of \$47 per share, and have made it a condition of the sale that the minority stockholders be given the right to dispose of their stock at the same price. Shareholders desiring to avail themselves of the option may, by presenting their certificates to the Guaranty Trust Company of New York, corner of Nassau and Cedar streets, receive cash for the same at the above named price of \$47 per share. The right to sell under the option will expire January 14, 1898." The "Eagle" adds: "There are so far as is known no stockholders who are complying with this notice and among the minority holders there is considerable indignation that their interests have not been better protected. There will of course be opposition to the reorganization plan on the part of these stockholders, and it is reported that already papers are being drawn up looking to the appointment of a receiver to secure for the minority at least as good terms as the majority stockholders have secured."

ELECTRICITY.

Vol. XIV.

NEW YORK, JANUARY 19, 1898.

No. 2

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As *ELECTRICITY* reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

Help to fight the Electrical Trust by subscribing
for *ELECTRICITY*.

CONTENTS.

Editorial Notes,	17-18
Electricity for the Elevated Roads.	
S. Dana Greene's Paper.	
A Wonderful Gur.	
The New York Electrical Society and the Electrical Exhibition.	
Under the Searchlight,	18
Is it Believed?	
A Trial Accumulator Car,	19
Manganese Dioxide in Lead Accumulators.	19
Edison and his Son (Cartoon),	19
The Relations Between the Customer, Consulting Engineer and the Electrical Manufacturer.	
By S. Dana Greene,	20
Railway Bonding. By Walter E. Harrington,	22
The New York Electrical Society,	24
Congressional Notes,	24
Dr. Herz's Claim for Indemnity.	24
The Brush Electric Light Stock Suit,	24
International Competition for the Phebe Hearst Architectural Plan of the University of California.	
Legal Notes,	25
Canadian Notes,	25
General News,	25
Personal and Miscellaneous.	
Recent Company Elections,	27
Commercial Paragraphs,	27
Incorporations,	27
Electrical Patent Record,	27
Telephones and Telegraph,	28
Electrical Securities—Stocks, Bonds, Etc.,	29
Notes for Investors,	33

EDITORIAL NOTES.

Electricity for the Elevated Roads.

It is now generally conceded that electricity will supersede steam on the elevated railways in New York City. After several years of discussion, drawing of plans and spending of money, the underground rapid transit scheme would seem to be dying. In view of this fact it is an exceedingly wise step the directors of the Manhattan Elevated Railway Company have taken in deciding to equip its lines with electricity. The system that will unquestionably be adopted is that generally known as the third-rail, similar to the method now in operation both on the Chicago elevated railways and on the Brooklyn Bridge. This third-rail system is economical of construction and has given so far fairly good results wherever it has been tried. Its principal objection would seem to be that the rail is constantly charged, and when located on land open to the public might lead to accidents. In the case of the Elevated system, however, this objection scarcely holds good, as the structure is not open to the public.

Our contemporary, the *Electrical World*, in a recent editorial apparently took an extremely optimistic view of the possibility of some such system superseding steam for suburban traffic. The editorial we refer to was a mild criticism of an article which appeared in the same issue of that paper on the difficulties of heavy electric railroading, by Dr. Louis Bell.

An elevated railroad equipped with electricity furnishes in reality nothing more than a trolley service on a large scale, and a suburban road in order to be operated successfully and economically by electricity would have to adopt this same service or run trains at exceedingly short intervals. As Dr. Bell aptly states in his article, there would be great danger of a suburban road equipped with electricity breaking down at some inopportune moment and delaying traffic for four or five hours, or possibly longer. The chances of such an occurrence happening could of course be reduced to a minimum by having all the apparatus in duplicate, but this would entail an immense outlay of money and not entirely do away with the possibility of such a mishap taking place.

As regards the danger attending the use of the third rail, a method has recently been patented which it is claimed will eliminate the objectionable feature attending the use of this system by making the conducting rail dead after the passing of a train. This is accomplished, so we understand, by having the top of the rail movable. A shoe on the car would touch the rail, move the top along a short distance until it became alive, and then take elec-

tricity from it. After the shoe has passed over the section the top of the rail returns to its normal position, which is accomplished by means of a spring, and the electrical connection is broken. For lines operating in the open, as for instance the electrically equipped section of the New York, New Haven and Hartford Railroad, this device if practicable should be of inestimable value and would do away with the trouble which attends the use of the present third-rail system, especially at highway crossings. Where there are movable parts in a system there is always a chance of their getting out of order, and experience has shown that reliance cannot be always placed on the action of springs; for this reason it would be well that the above system should undergo a thorough test before being adopted anywhere on a large scale.

Presuming the third-rail system is adopted by the Manhattan Elevated Railroad, there are a number of methods by which the trains may be propelled. They can either be drawn by separate locomotives or arranged on the Sprague unit system, which is in operation on one of the roads in Chicago, or have electric motors placed on each car. In all probability a modification of the latter method will be adopted, and in place of the steam locomotives an equal number of motor cars will be used. These electric car locomotives, as they might be termed, will then be employed to draw one or more ordinary coaches.

It is claimed that by the use of electric motors the time consumed in making a round trip will be greatly reduced and thus a species of rapid transit will be secured. In any case the change when made will certainly be for the better as far as the public is concerned. The people living along the lines of these railways would no longer be obliged to keep the windows closed in summer to prevent the admission of steam, smoke and gases which are constantly given off by the engines now in use. The necessary power to operate these systems will in all probability be generated at various points along the river front where coal can be delivered economically. One important point seems to have been overlooked regarding the equipping of the elevated roads with electricity, namely, the possibility of electrolysis. If the Brooklyn Bridge is in danger of being destroyed by electrolytic action, as several newspapers would have us believe, there would seem to be no reason why the elevated structure should not likewise be affected. Were this action to take place, the supporting pillars would probably be greatly weakened. This would be a very serious matter, as the structure as it stands will be none too strong for the number of trains and the load it will have to carry. When these roads were first constructed, the traffic was comparatively light and trains consisted of only a few cars. As it became necessary to afford greater accommodation more cars were added, trains were run at shorter intervals, and in several places a third

track was laid for the use of express trains. Now still greater speed is desired, and it is thought this can be obtained by adopting electricity. The traffic will certainly not diminish, but on the contrary should greatly increase. This means that the structures will come very near being overloaded unless proper precautions are taken to strengthen them. When this system was built, some twenty years ago, undoubtedly a suitable factor of safety was allowed. It might be exceedingly interesting to ascertain what this factor of safety is at the present time. This is too important a point to be overlooked, and now that better methods are shortly to be adopted it would seem to be an extremely opportune moment for the management of the road to have any weak points in the structures suitably strengthened.

As yet it is impossible to say who will get the contract for providing and installing the electrical apparatus. From all accounts the Walker Company would seem to stand an excellent show, but the probabilities are that the contract will be divided. We trust Mr. Gould's recent statement in the *New York Sun*, to the effect that a change of motive power would be made with as little delay as possible, actually means that work will shortly be begun. There has been enough talk about rapid transit and contemplated improvements without anything having been accomplished; what the people now want is to actually see the work begun.

* * *

S. Dana Greene's Paper.

The paper recently read before the New York Electrical Society by Mr. S. Dana Greene, entitled "The Relation Between the Customer, Consulting Engineer and the Electrical Manufacturer," and to which we give space in this issue, is exceedingly clear, concise and very timely. Mr. Greene opens this paper by giving a short sketch of the electrical industry between 1887 and 1892, when electric railway plants were springing up all over the country and consulting engineers were few and far between. The installations at this early period left necessarily much to be desired, as technically educated electrical engineers were scarce. The author of this paper aptly calls attention to the fact that a large portion of the profits of the business both of the operating and manufacturing companies was spent at the close of this early period in rectifying defects. With regard to the consulting engineer, Mr. Greene acknowledges that he is a necessity and a proper connecting link between the manufacturer and customer. His function, without a doubt, is to see that his client who buys apparatus and installs it selects that which is best suited to the local conditions. It is to be deplored that the majority of consulting engineers at the present day, more especially those who have recently commenced practice, as Mr. Greene states, decline to be brought more closely in contact with the manufacturers with a view to ascertaining what the latter can reasonably be called upon to make. This lack of knowledge of what the various manufacturers can turn out without having to make new patterns, special tools, dies, etc., frequently entails extra expense to the customer and annoyance to all parties concerned. The advantage of specifying standard apparatus lies in the fact that if any part of a machine ultimately proves defective or wears out it can quickly be replaced at a comparatively slight cost to the purchaser.

With the special apparatus, which is now unfortunately being more and more frequently called for, when any part has to be renewed it entails a useless expense and generally delay.

The point in this paper regarding the length of specifications now furnished by consulting engineers in general is well taken. At the present stage of the art any first-class manufacturer is thoroughly capable of turning out good apparatus without the consulting engineer having to specify exactly how it

shall be made. This portion of the work should be left to the judgment of the manufacturers, who would then naturally be held responsible for the satisfactory running of apparatus after completion.

Let a consulting engineer confine himself to calling for the most suitable system to meet the case and specifying what tests the various machines shall be put through, and leave it to the maker to see that the machinery is capable of standing such tests.

We trust the younger element of consulting engineers now practising do not intend to seclude themselves as some of the architects in this city have done and continue to do. Mr. Greene's paper would rather lead us to believe there is a tendency in this direction. We refer to the way some architects have of hiding themselves from callers in an inner sanctum sanctorum, protected by youths scarcely out of the nursery, who hold all callers at bay from behind a barricade consisting either of a table or a partition in which there is a pigeon-hole window, and through which the visitor has to pass a written statement of his business before gaining admission. Verily it would appear harder to reach the presence of a large number of our architects and a few electrical engineers than for a camel to pass through the eye of an needle.

Mr. Greene's paper is a forcible presentation of his views, and there are many points well taken. Any action towards bringing the manufacturer, consulting engineer and customer more closely together will certainly be welcomed by the electrical industry in general.

* * *

A Wonderful Electric Gun.

An electric gun is now being patented by John H. Hartman, a veteran of the Civil War, which, provided it accomplishes what seems to be expected of it by the inventor, should go far towards revolutionizing modern warfare. This new weapon is designed to discharge a current of electricity at any desired voltage, the transmitting path or circuit consisting of the rays from a powerful searchlight. The principle upon which the invention is based, according to Mr. Hartman, is that under certain conditions the light waves will carry the current, and those upon whom the light is turned will receive a shock as though they had come in contact with a live wire. He moreover claims to be able to shoot an electric current as far as a searchlight will throw the rays. In support of his theory he points to the fact of having tried such an experiment on a rabbit with a fifty-volt alternating current which almost resulted in the death of the animal.

In a recent issue of the *New York Press*, Mr. Hartman is credited with having made the following statement:

"My gun is being built in Bridgeport. It will be ready in the spring for a test. The gun will stand on a tripod and can swing in any direction. A button pushed sets it in operation. The current I expect to use will be the highest alternating current obtainable; the higher the more deadly and the further it will carry. A man operating this gun can swing it to the right or left and everything it strikes will go down. It can be focused and sighted the same as any gun. Its use, of course, will be limited, as it has to be connected with powerful dynamos. But when thus connected it cannot be compared with anything now in use. A stream of water will carry a current of electricity, but you cannot shoot it far enough to make it effective. The light rays will carry it an immense distance. The Government will give me a trial, I am certain. They are now using an invention of mine, the Hartman carbine socket. They have been using it since 1880."

It is to be regretted that the inventor of this new implement of warfare fails to state what the certain conditions are that make the rays of a searchlight a good conductor. Rays of light necessarily pass through the air, and as the latter in a dry state is one of the best dielectrics known, it is rather difficult

to see how such an apparatus can accomplish what is claimed for it.

The inventor states that experiments will be made in the near future on a comparatively large scale with the gun which is now being constructed, and the result of these tests, if ever made public, will undoubtedly be of interest to the electrical fraternity.

* * *

The New York Electrical Society and the Electrical Exhibition.

With a view to enlarging its scope of usefulness, the New York Electrical Society, the oldest electrical body in the country, has decided to co-operate with the Electrical Exhibition Company, which will hold its next Exhibition in Madison Square Garden in May of the present year. At its recent meeting the New York Electrical Society passed the following resolution:

"Resolved, That having heard the report of the officers of the Society in regard to the arrangement effected for co-operation with the approaching Electrical Exhibition in the city, the members hereby express their hearty approval and pledge themselves to active work that shall make the most of this opportunity for promoting the interests of electricity and the welfare of the Society."

The hearty co-operation of such a distinguished body as the New York Electrical Society should go far towards making the coming Exhibition even more successful and popular than that of 1896. The coming together of these two organizations will unquestionably be to their mutual advantage, and assures beforehand the complete success of the Exhibition. The latter deserves to be highly commended for the courtesies it has extended to the Society in placing a booth at its disposal as a rendezvous, and agreeing to turn over to it a percentage of the admission receipts for educational work. Under the auspices of the New York Electrical Society the Madison Square Garden Exhibition cannot help but be a far greater success than any that has been given heretofore.

Under the Searchlight.

Notes and Comments on Various Topics.

Is it Believed?

(From the Boston News Bureau.)

Matters in respect to General Electric preferred stock are approaching a solution and it is believed that before July 1 next stockholders will receive a proposition from the company. There is now 31% per cent. or 4% years accumulated dividends on General Electric preferred.

This is apparently the same old story that has been harped on time and again. The stockholders are now given a quasi promise that some proposition will be made them by July next. Some months ago the investors' spirits were kept up by vague intimations that some kind of a settlement of unpaid dividends would probably be made by February. Now comes a rumor that something will surely be done by July. When July comes it will probably be February, 1899, when matters will be straightened out; and thus time passes, the stockholders are kept on the anxious seat and the unpaid dividends continue to accumulate. The stockholders in the General Electric Company must surely be an amiable and patient set of people.

* * *

REGARDING a scheme of the incandescent lamp combination to drive all the independent manufacturers of similar products out of business, which appeared in our issue of December 29, our representative recently visited the office of the Royal Incandescent Lamp Company in Cleveland, which he found located at 7 Water street, with a view to obtaining a little general information. Each time he called he was informed that the party who gave information was out, so as a last resource Mr. Charles

Rockwell was interviewed. This gentleman made the statement that the company was asking no credit and was paying cash for everything. This would seem plausible, as the total visible property of the concern apparently consists in a desk and a few chairs, although it may possibly be that the company is not as yet in shape for business. If the object of this organization is to supply lamps manufactured by the various concerns in the Pool, a large outlay of capital would naturally be wholly unnecessary.

* * *

AN electrically illuminated keyhole promises to be as common, so it is claimed, as the ordinary push-button door-bell. A Denver man has invented this device, which consists of a small incandescent electric lamp located inside the lock and a push-button projecting through the casing. On pushing the button the lamp is lighted and throws a brilliant stream of luminous rays through the keyhole. On throwing back the bolt with the key the lamp is automatically put out. The inventor's idea probably was that such a device would be of inestimable value to belated clubmen, but if such is the case he had better re-design his apparatus and make it automatic from beginning to end. Is it reasonable to suppose that a clubman who was kept out late "sitting up with a sick friend" could ever find the push-button to start the light in the first place?

* * *

A FLOATING newspaper paragraph states that the Westinghouse Company has secured the contract for lighting some half dozen catacombs in Rome by electricity.

"Some months ago," the paragraph informs us, "the subterranean burial ground of St. Callistus was lighted, and the effect was so satisfactory that the persons in charge decided to have electricity put in all the catacombs of the city. Six motors capable of supplying current for no less than 450 lamps will be placed in the six catacombs."

The Westinghouse Company must have experienced some difficulty in securing those "good European contracts" when its representatives were forced to nose around the noisome Roman catacombs for a job. Mr. Coffin's representatives would never have thought of such a thing.

* * *

I wish to protest against the many articles appearing in the sensational papers of New York from time to time purporting to be interviews with me about wonderful inventions and discoveries made or to be made by myself. Scarcely a single one is authentic, and the statements purporting to be made by me are the inventions of the reporter—the public are led from these articles to draw conclusions just the opposite of the facts. I have never made it a practice to work on any line not purely practical and useful, and I especially desire it to be known, if you will permit me, that I have nothing to do with an article advertised to appear in one of the papers about Mars.

THOMAS A. EDISON.

That the above card should appear in the New York World is little short of laughable, when it is recalled how frequently this sensational paper comes out with startling discoveries and tales of wonderful inventions. Mr. Thomas A. Edison is in the right in objecting to the promiscuous use of his name attached to sensational articles; and if Mr. Tesla could only be induced to follow the example set him, some of our dailies would be pretty badly off for sensational scientific matter.

The Electric Railways of Canada.

There are 569 miles of electric railways in Canada, exclusive of those in British Columbia. Statistics show that the train mileage run in 1896 was 22,917,151, and the number of passengers carried was 73,496,069. The total capital and bonded debt was £4,600,000. There were in use 947 motor cars, with 1,315 motors, 380 trailers, and 62 street sweepers and snow-ploughs, while the total number of hands employed was about 3,400.

A Trial Accumulator Car.

A new accumulator car, says the *Elektrotechnischer Anzeiger*, was exhibited to a party of engineers and pressmen on one of the Berlin steam-tramway lines on December 18th last. It is a four-wheeled car built and equipped by Messrs. Kummer & Co., of Dresden, the accumulators being of the Ribbe type. The car is provided with 20 seats and standing room for 11 passengers, not including the driver and conductor; it weighs empty, but with its battery, 10 tons, and it is driven by a single 30 H. P. series motor. The speed regulation is effected by means of a water resistance and by series-parallel arrangements of the cells. Forty-four boxes, each containing three cells, are placed under the seats, each box measuring 7½ in. by 5½ in. by 12 in. high, and weighing complete about 170 lbs., the whole battery weighing, therefore, about 67 cwt. The boxes are sealed with covers and rubber packing, and there

and the latter is retained in contact with the grid by perforated celluloid plates 0.02 in. thick. The celluloid strips referred to hold these celluloid plates in position. The negative plates are also provided with separating pieces of celluloid $\frac{3}{8}$ in. high. It is stated that the celluloid contains but a very small percentage of sulphur, so that it does not act in any way on the lead grid, and it is said to have lasted for nearly three years in some cells made by a Paris firm.—*The Electrician, London.*

Manganese Dioxide in Lead Accumulators.

Mr. G. von Kuorre, in the *Zeitschrift für Elektrochemie*, gives some interesting facts relating to experiments carried out by him with regard to the use of manganese in accumulators. He states that a freshly-charged positive plate, dipped into sulphuric acid containing manganese sulphate, at once gave the pink color and the absorption spectrum of perman-



"TOM, DON'T YOU THINK YOUR HEAD IS LARGE?"

Reproduced from the New York Evening Telegram.

are tubes to lead off the gas. The cells themselves, which are said to be made of celluloid, each contain seven positive and eight negative plates, measuring 12 in. by 7½ in. by $\frac{3}{4}$ in. thick, with the exception of the two outside plates, whose thickness is only $\frac{3}{8}$ in., the weight of the plates being 2.5 and 1.8 lbs. respectively.

From figures supplied by the makers the cells can be discharged in 5½ hours, with a current density of 0.045 ampere per sq. in.; this corresponds to a current of 55.3 amperes and a capacity of 304 ampere hours, or about 8½ amperes per lb. of plate. The normal current is, however, only 35 amperes, and the battery is intended for a whole day's work of 16 hours without being re-charged. The grid consists of a lead frame 0.14 in. thick, with a perforated partition 0.04 in. thick. On each side of this partition narrow strips of thin celluloid are fastened by means of celluloid solution, then comes the active material

ganate. The same acid is formed when a positive plate on which some manganese dioxide is spread is immersed in sulphuric acid. On the other hand, a permanganate solution is discolored by a negative plate, and a lead glycerate plate containing manganese dioxide and coupled as cathode with another plate during formation soon made the anode red, although the sulphuric acid and the anode were free of manganese. The author concludes that there is little doubt but that the manganese acts as oxygen carrier from the positive over to the negative plate, and impairs the capacity of the cell; and that the fact that we do not notice the color reaction in ordinary cells is due to the circumstances that the oxidation and reduction proceed simultaneously. An accumulator which has been prepared with manganese salts is said to become quickly discharged. The author strongly advises that manganese compounds should be avoided in electric accumulators,

THE RELATIONS BETWEEN THE CUSTOMER, CONSULTING ENGINEER AND THE ELECTRICAL MANUFACTURER.*

BY S. DANA GREENE.

The subject which I have chosen for this paper is an eminently practical one, and I shall endeavor in my remarks to call attention to certain causes of friction which at present exist between the parties in interest, and to suggest certain remedies which may serve to bring about a better understanding and to lessen this friction, which is, in my opinion, entirely unnecessary.

In order to discuss intelligently present conditions it is advisable to trace briefly the development of the electrical business, and to do this one need hardly go back more than a dozen years. At that time electric lighting was still an experiment (from the commercial standpoint), electric railroading had not begun, and electric power transmission was discussed as one of the possibilities of the future. Very few of our institutions of learning had established separate electrical courses, and such a thing as a consulting electrical engineer hardly existed in this country. The few men who had some theoretical knowledge were eagerly caught up by the manufacturing companies, who had difficulty to find men capable of solving the many pressing practical problems with which they were confronted when they began to sell electric machinery. Thus the development of a practical generator and incandescent lamp immediately created a demand for suitable conductors and materials for outside and inside wiring, safety devices, etc., as well as close regulating engines, proper station appliances and many other things which are to-day regarded as "standards" in the business. It was less than a dozen years ago that the first fireproof switchboard was installed, in the Broadway Theater, New York. The specifications were drawn by a consulting engineer—a naval officer, by the way—calling for a fireproof structure, and the manufacturer no doubt accepted the order thinking that he could use what had always been used before, viz., a wooden framework. In this he was mistaken, however, and after a year's wrangling a slate board was installed, much to the manufacturer's disgust and at great expense to him. It is hardly necessary to say that this form of switchboard became standard immediately, and several years after, the manufacturer happening to meet the naval officer, said to him: "Someone was a d—d fool about that switchboard, and *you* were not the man." I well remember when I left the Navy to join the Sprague Company in June, 1887, I found that the technical force of the company consisted of Mr. Sprague, an ex-naval officer, and Lieut. Crosby, who had just left the Army. Upon explaining to the former how modest was my store of knowledge on the subject of "electric street railways," he at once assured me by saying that we were all in about the same boat and that there was a fine opportunity to learn. My opportunity came sooner than I expected when, about July 1, I was charged with the execution of a contract for the equipment of a 40-car road in Richmond, Va., which, under the terms of the contract, was to be in full and complete operation on the first of the following October.

Doubtless most of those present to-night can recall the remarkable growth of electric lighting and railway work during the next five years, from 1887 to 1892, a growth that can fairly be called tropical. Plants sprang up in nearly every city and town in the country, and manufacturers sprang up with equal rapidity. There seemed to be unlimited money ready to invest in electrical enterprises, and the anticipated profits were such as to make the old established manufacturing industries seem very poor investments. During this period, which may be called the "forced expansion period," purchasers usually

had to take what they could get, and consulting engineers were few and far between. Specifications for apparatus or installations, when there were any, were generally prepared by the manufacturer, and the purchaser rarely knew whether they had been fulfilled or not. By the close of this period, however, the colleges and technical schools began to turn out men who had taken special courses in electricity and who naturally looked for a chance to make an honest living. The first great demand of the manufacturing companies for technical assistants having been satisfied, many of these young men found their way into local operating companies, or else established themselves as consulting or contracting engineers, in which positions they found plenty of work; for by this time the imperfections in the earlier installations and types of apparatus had become plainly evident to the purchaser as well as to the manufacturer, and there was a general demand for better workmanship and more rigid requirements in installation. It may be here noted that much of the "anticipated profit" of the business, both of the operating and manufacturing companies, was spent subsequently in making good these early defects; and while the business as a whole profited largely by this reconstruction process, it naturally dampened the enthusiasm of the early investors.

In 1895 came the panic, and for the past four years there has been a wonderful record of savings and economies both in electrical manufacturing and operating companies, as well as a great improvement in quality of product. It has been, in fact, the "economic and reconstruction period." The operating companies have learned that they too are manufacturers of a product, electricity; and as these hard times have forced down the price of their product, they, like the manufacturers of apparatus, have had to keep their heads above water and their companies out of receivers' hands by the introduction of more economical and improved methods of manufacture and of administration. During the past year there has been a marked improvement in the electrical business; it is to be hoped that this improvement is permanent, and that the past four years of retrenchment and economy have paved the way for a normal and steady growth on conservative lines—in other words, for a period of "natural expansion." The business to-day is on much the same basis as in other industries where prices are close, competition keen, and where a better article is furnished for less money than ever before.

The manufacturers of apparatus and the manufacturers of current are dependent upon each other to a large extent and their relations should be close and friendly. The consulting engineer, as in other engineering trades, is a necessary and proper connecting link between the two, and I can say frankly that I believe he has a proper and permanent field of usefulness. Broadly speaking, his function is to see that his client who buys apparatus and installs it selects first that system best suited to his particular local conditions, and then, in purchasing, secures the best (not necessarily the *most*) for his money. It is equally the duty of the consulting engineer to learn what the manufacturer can reasonably be called upon to make, to consult with him freely and to obtain the benefit of his experience; to give him credit for work well done and to insist that bad work shall be promptly corrected. Many consulting engineers, especially those who have recently commenced practice, seem to think that it is improper for them to consult with the manufacturer, or to examine his plant, or to ask him for information or advice. Their idea seems to be that by so doing they may be accused of partiality or undue bias, or with lack of proper care for the interests of the purchaser; or they may feel that it is derogatory to their own dignity as engineers. The inevitable result is that specifications often contain provisions which are a sort of annoyance and expense to the manufacturer and purchaser alike, and which have no compensating advantages from either the engi-

neering or commercial standpoint. In fact, some of these provisions are impossible or impracticable of fulfillment, and in such cases the honest manufacturer who wishes to meet the specifications and guarantees required finds himself forced to ask the engineer or the purchaser (sometimes both) to modify them. This is a proceeding which is always difficult and delicate to undertake, and often results in friction and trouble for all concerned. I am satisfied that if every consulting engineer would take advantage of opportunities as they occur to visit manufacturing establishments, see the work there in progress and confer with the engineers, he would find himself well repaid for the visit and his own work and practice benefited thereby. I am equally satisfied that no reputable manufacturing establishment would refuse admittance, but on the contrary would welcome such visits as beneficial to both parties. The day of mysterious methods of manufacture, carried on behind closed doors, is passed in the electrical business, and I appeal with confidence for an endorsement of the opinions just expressed to those consulting engineers who have already tried the plan suggested. I have said that I thought the engineer would find himself repaid by such visits. I think also that he will find himself in a better position to advise his client intelligently. A purchaser usually knows little or nothing of the relative technical merits of apparatus, and his final decision is governed largely by price and by paper statements and guarantees, which may mean much or little. The consulting engineer who has seen the apparatus in process of manufacture can advise, not only as to whether the various bids comply with the specifications, but also what make or makes of apparatus are, from their design, construction and factory inspection and test, most likely to give the least trouble and expense in continuous service.

Some engineers seem to measure their value to the purchaser by the length of their specifications, and some of these formidable documents strike terror to the heart of a busy man confronted by a deskful of mail. The specifications not only specify what the conditions of service are, what apparatus is required, and what tests shall be applied to it for acceptance, all of which are quite proper, but also *how it shall be built*, which is another matter. The electrical manufacturers of this country, following the admirable precedent which has given American manufactured products (particularly machinery) a world-wide reputation, have endeavored to establish standard lines of apparatus whenever the permanency of type and the size of the demand warrant it. This practice not only tends to reduce cost (and with it price), but also enables the purchaser to secure quickly and at a minimum of expense, duplicate parts which are really duplicates, and which can be fitted without the aid of a skilled mechanic. It is the American system of standard lines of machinery and interchangeability of parts which has stood the test of time and which holds its own against all competitors. This system, however, is possible only where the same article is manufactured in quantity, since the expense of designs, drawings and patterns, special tools, jigs, dies, etc., is prohibitive unless spread over a large production. On the other hand, if special apparatus is required, it means a relatively large expense for these items which cannot be charged to a standard product, and which thus constitute a handicap both to the manufacturer and the purchaser. A machine is "standardized" only after long experience both in manufacture and service, and other manufacturers (the builders of engines, trucks, etc.) as well as the users, are invariably consulted before such standardization. It would appear to be to the interest of both seller and buyer to use such standard machines wherever and whenever possible; and yet it seems to be a fact that the demand for special machines is increasing rather than decreasing as apparatus becomes more generally standardized. To prove this I can cite the experience for the past year of one manufacturing

* Paper read before the New York Electrical Society, Jan. 12, 1898.

company with which I am familiar. During this period the designing engineers were called upon for estimates on special apparatus, as follows:

Direct current: No. of estimates, 300; No. of kw. of apparatus involved, 31,000.

Alternating current: No. of estimates, 300; No. of kw. of apparatus involved, 131,200.

These estimates were all embodied in formal propositions; besides these there were between two and three times as many preliminary estimates required to answer inquiries of customers, which the engineers had to prepare.

This was in addition to their regular work on standard lines of apparatus, of which there are over thirty. Some of this work was undoubtedly due to new developments in the business and to new methods and inventions, a condition which, although unfortunate from the manufacturing standpoint, must exist for many years to come; but a great deal of it was also due to the fact that specifications call for special apparatus, or methods of construction, where standard apparatus and methods would do equally well. This experience I find is common among electrical manufacturers, and I attribute it largely to lack of touch between the manufacturer and the engineer drawing the specifications, whether he be regularly employed by the purchaser or retained in an advisory capacity. Let the engineer see more of the manufacturer and his work, and let him hold the latter responsible for results as determined by proper tests, leaving the details of construction where they belong, in the manufacturer's hands.

This brings us to another phase of the subject, viz., the tests and guarantees prescribed by specifications. Omitting from consideration matters which, as already stated, belong properly to the designer and builder, such as current densities in the windings or in brushes, methods of insulation, kinds of material, etc., etc., the tests necessary to determine a machine's quality (and hence its value to the purchaser) are few in number and can be enumerated under the headings of *efficiency*, *heating*, *regulation*, *sparking* and *insulation*. If the requirements under these five headings were formulated under some general rules, and if the methods of tests to determine results were uniform, the work of the consulting engineer and the manufacturer would be vastly lessened. Such unfortunately is not the case, and specifications on these points vary widely both as to requirement and as to the method of test. It seems practically impossible for the various manufacturers and consulting engineers to standardize these requirements and tests by any concerted action, and the only other solution of the difficulty is for some scientific, non-partisan organization to undertake the work. The American Institute of Electrical Engineers is just such a body, and it would render a great service to the entire electrical business if it would consider the matter. Without attempting in any way to suggest what action it should take, it seems proper to call attention to some of the points which most frequently give rise to misunderstandings and disputes.

1. *Efficiency*.—The proper distinction between electrical and commercial efficiency is not made. The latter is what interests the purchaser, and it should always be specified. A clear statement of what losses must be included to determine it, and also a general statement of what constitute reasonable and proper commercial efficiencies in well designed machines, would be of great service. Such a statement should show the necessary difference between carbon and copper brushes, and between the voltages most commonly used in direct current work, viz., 125, 250 and 500 volts, as well as between machines of various sizes. The formulation of such information on alternators is more difficult, but all manufacturers have certain standard lines of these machines and it is quite possible to make some intelligent general rules.

Electrical manufacturers are sometimes required

to guarantee the combined efficiency of generator and engine (or other prime mover). This is clearly unfair and shifts the direct responsibility of guarantee from the maker of the prime mover, where it properly belongs.

2. *Heating*.—For all ordinary conditions of service, the safe heating limits for continuous full load operation can be determined with a fair degree of accuracy. The commutator heats more than any other part of the machine, particularly with carbon brushes, a fact which is often ignored. Sometimes the heating is measured by thermometer, sometimes by increase in resistance. There should be one uniform method followed. Overload guarantees (ranging from 25 per cent. to 100 per cent.) are sometimes required for a period within which the ultimate temperature of the machine is reached, and the necessary capacity of the machine is thus increased as certainly as though a larger machine were specified. It would seem that the time duration of overload tests should bear some relation to service conditions. If the service requires a 50 per cent. overload for eight hours or more, a larger machine is evidently necessary.

3. *Regulation*.—Specifications frequently call for a straight line compounding curve, a condition which is practically impossible until we discover a magnetic material which has a straight line saturation curve. Another common requirement in the case of lighting generators is that a drop of say 2 per cent. in speed shall not affect the electromotive force more than two volts, which is also an impossible condition even with a separately excited generator. A reasonable margin in either case, having due regard to the service for which the generator is intended, should always be allowed.

4. *Sparking*.—Modern design and the use of carbon brushes have greatly reduced the trouble from sparking, but machines are sometimes called upon to stand excessive overloads without sparking, which can be accomplished only by using a larger machine or by a distortion of design, which is bad practice. Any good machine with carbon brushes should be able to stand a variation from no load to full load without movement of brushes and without noticeable sparking; it should also stand a reasonable overload, say 25 per cent., without injurious sparking.

5. *Insulation*.—This is a cause of frequent trouble and annoyance. The common practice is to specify an insulation resistance of so many megohms, regardless of the size of the machine and the voltage and conditions of service. Considering the fact that this resistance varies inversely as the area of surface to be insulated, and considering the enormous variations in size, shape, voltage and service requirements of different machines, it is evident that such a test is impracticable and means little or nothing. Insulation resistance is largely a question of dryness, and if an armature be baked for a sufficient length of time almost any resistance within reason can be obtained. I have known a large 400 kw. lighting armature to measure a megohm resistance, as required by specifications, after several days' baking (which by the way permanently injures the structural strength of the insulating material), and yet it showed practically no resistance when it reached its destination, because it had been in the rain and dampness for a week or more, and the large surface naturally afforded an excellent lodging-place for moisture. A dry run in a weak field, with the armature short-circuited, quickly brought the insulation up again.

The only proper way to insure good insulation, with reference both to the material used and the method of construction employed, is by a *high potential* test applied when the machine is reasonably dry. This test should be intelligently gauged by the voltage of the machine and the service required. Thus a high potential test of 1,000 volts is ample to detect any insulation weakness in a 125-volt lighting generator, while a 5,000-volt test is ample for a 1,000 volt alternator, allowing proper factor of safety in each case. Recent careful investigations have devel-

oped the fact that the only correct way in which to determine the proper high potential test for any given machine is to consider jointly the time duration of test, the current frequency and the voltage of machine. As the latter rises, the margin between it and the test voltage necessarily decreases, on account of the liability to permanent injury of the insulation when subjected to excessive voltages. Because 5,000 volts is found to be a proper test voltage for a 1,000-volt machine, it by no means follows that 50,000 volts is proper for a 10,000-volt machine, or that the apparent factor of safety should be the same as the voltage rises. There should be a careful formulation of proper high potential tests for different classes of apparatus, based upon scientific investigation and tests, and it is believed that it would not be a matter of any great difficulty to formulate such a schedule.

It is earnestly to be hoped that the Institute will consider that these questions come properly within its sphere of action, and that it will take action in a matter of so much moment to all concerned. It should be remembered that where special conditions are imposed which lead to distortion of design or to the manufacture of special apparatus, the purchaser, no less than the manufacturer, is bound to suffer, and it is the purchaser who pays the bills, directly or indirectly. If the purchaser finds himself involved in unexpected expenditures, the consulting engineer, too, comes in for his share of blame and dissatisfaction.

We come finally to the commercial requirements which have gradually found their way into specifications, and which are sometimes onerous and unfair. Perhaps the most important of these is the question of shipments. It is not uncommon for shipment to be specified by a certain date, under a forfeiture of so many dollars a day for each day's delay thereafter, and the award of the contract is often largely affected by such promises. The manufacturer starts the work in his shops and if the time is short he is apt to work overtime. About the time the apparatus is ready for shipment, and without any previous warning, word comes to withhold shipment because the purchaser is not ready to receive it. There were recently fifteen carloads of apparatus lying in the yards of one of our manufacturing establishments, besides a number of large machines stored in the shipping and testing departments, which had been made on time contracts and held at the last moment by request of the customer. It is difficult for one not in this end of the business to realize the resulting demoralization throughout the shops, and it is a condition which could easily be remedied by the exercise of more foresight on the part of the purchaser and his engineer. In all cases where a penalty for delay in shipment is imposed, it is fair and reasonable to ask that a similar bonus should be awarded if shipment is made in advance of promised date, or if the purchaser is unable, through no fault of the manufacturer, to receive the apparatus on that date. It is sometimes required that the consulting engineer shall have free access to the shops at all times while the apparatus is in production. Such permission is impracticable if proper shop administration and discipline are maintained, and these visits should be made at certain specified stages of the work. It is of course always proper for an engineer to be present when the apparatus is finally tested.

A clause is commonly found in specifications providing that the consulting engineer shall be sole judge of the true intent and meaning of the specifications; and in case of any dispute thereunder his decision shall be final and binding. It is true that this clause is common in architects' and builders' contracts, but it is doubtful whether it could be enforced at law in case of a dispute as to facts, and it certainly seems fair that in case of such a dispute, where the two parties honestly disagree, provision should be made for a third, disinterested party to act as arbiter.

While there are many contracts executed which involve one or more of the provisions (technical or

commercial) mentioned above as liable to cause trouble, and where no trouble is experienced, due to the common sense and good judgment of both engineer and manufacturer, still the cases where trouble does arise are not infrequent, and the best specification is one so fair and so clear that no dispute or misunderstanding can arise except with malicious intent, and which requires no arbiter to interpret its true intent and meaning.

In conclusion let us hope that the customer, the consulting engineer and the manufacturer will in the future consult each other more freely and frankly, by personal interview or by correspondence, and that all of them will unite in endorsing any intelligent attempt to standardize such tests and technical requirements of electrical apparatus as are matters of common usage in our daily business intercourse.

RAILWAY BONDING.*

BY WALTER E. HARRINGTON.

Each manufacturer of rail bonds states his bond to be the best; the number of bonds now upon the market approximate closely about twenty different designs.

It is a difficult matter to determine which bond is the best adapted to your conditions. What may possibly answer under certain conditions will not answer under others. The majority of bonds are designed to make lateral contact with a hole in the web of the rail. This at once defines the necessity of good, clean, uniform surface in the hole, in order to insure good contact. While it may seem an easy matter to obtain good, clean, uniform surfaces, the facts are, that in the majority of instances, holes are not true and are full of ridges.

The writer has frequently removed bonds where it seemed as if every precaution possible had been observed to make good contact, with barely more than 10 per cent. of contact. In some instances, the bonds could be readily pulled out of their holes.

Furthermore, rails will be either punched or drilled for bonds by the mill, and the holes will frequently become coated with rust before the rails are placed, resulting either in the necessity of using a file or reamer, making the holes larger than they should be. I do not wish to convey the impression that good contact cannot be made with bonds making connections through a hole in the web of the rail, as this can be done; but the frequent bad contacts upset one's confidence in them.

The use of the Edison-Brown amalgam, to improve the contacts of copper bonds, showed some very interesting results; used with the Crown bond, manufactured by the Washburn & Moen Manufacturing Company, the joint showed a decrease of 24 per cent. in resistance by amalgamating; whereas the Columbia bond, manufactured by the John A. Roehling's Sons Company, only showed a decrease of 5 per cent., showing conclusively that the forms of contact made by the Columbia bond is far superior to the Crown. This is substantiated by the data in the accompanying table, which show that the Columbia

The troubles incident to making contact in a hole in the web of the rail led to the trial of the much-abused Bryan bond. This bond consists of a large number of parts, and is open to the objection that a bronze casting is used as part of the conductor. The bond, in brief, consists of two No. 0000 copper wires, clamped by bronze and iron castings, the bronze casting in contact with a corrugated copper washer, which is in contact with a freshly-made contact surface upon the face of the rail; the whole held together by a 1-inch bolt and nut, with a lock washer. This bond overcomes the radical objections inherent in the type such as the Crown, Columbia, depending upon their contact with the sides of a hole. The resistance of such a bond without the Edison-Brown alloy is very high. Compared with two Crown bonds non-amalgamated, it shows a resistance of 116 per cent. higher, but the amalgamation makes a remarkable difference; comparing it with the non-amalgamated Crown bond, makes a difference of just 42 per cent. in favor of the Bryan (when amalgamated), whereas compared with two Crown bonds, amalgamated, makes a lesser difference of 23 per cent. in favor of the Bryan bond, amalgamated, with a still further advantage of permanency.

The great objection to the Crown, Columbia, etc., type of bonds consists chiefly in the mechanical defects inherent in them. The vibration of the rail, with the play of the rail joint, results in a continual stress upon the small area of the contact, followed with the final loosening of the bond.

The writer has removed bonds of the above types which had been in service only a few years, and that had become loose, and the continual movement had worn the bond approximately 1-inch smaller in diameter in places. The Bryan bond and those types which are flexible, particularly the Edison-Brown type, are free from such mechanical defects.

While it is not the purpose of the writer to make the tests herein outlined to demonstrate the virtues of the Edison-Brown, still the results were so pronounced that especial stress is laid upon them, particularly since practical experience has demonstrated their permanency.

It will be noticed that the plastic cork type of Edison-Brown bond gave the lowest resistance of any of the bonds tested.

Conclusions:

- (1) The Edison-Brown plastic cork bond gives the best results.
- (2) The Standard bond, under fishplate, is excellent, but is difficult to place.
- (3) The Bryan bond is the best round fishplate type of bond, both electrically and mechanically, provided, however, that the bond is thoroughly amalgamated with the Edison-Brown alloys.
- (4) The Crown and Columbia types of bonds would not be so objectionable if they were stranded and the strands protected from electrolysis.
- (5) The Crown type of bond is rendered materially efficient by the use of the Edison-Brown alloys,

Kind of Bond.	Center to center of contacts.	Length of bond.	Size of contact.	B. & S. gauge.	Number of wires in bond.	Ohms.	% res. $\frac{A}{B}$
	Inch.	Inch.					
Joint only—no bond.....	36	..	9-16" pin.....	..	..	.00471	..
Iron channel pin.....	45	48	Plate 2 1/2" d., 1" hole in it	1 1/2"	1	0.019	69
Bryan—iron wire.....	36	39	7" head.	0000	2	.000286	40
Crown.....	30	36	Plate 2 1/2" d., 1" hole in it.	1 1/2"	1	.000217	34
Bryan—iron wire, amalgamated.....	36	39	7" head.	0000	2	.000224	31
Crown, amalgamated.....	30	36	7" head.	0000	1	.000185	26
Bryan—copper wire.....	36	39	Plate 2 1/2" d., 1" hole in it.	0000	2	.000175	24
Columbia.....	30	26	7" head.	0000	1	.000131	18
Columbia, amalgamated.....	30	36	7" head.	0000	1	.000126	17
Stranded crown.....	5	7	7" head.	0000	1	.0001	14
Plastic socket.....	31 1/2	..	..	..	..	.000093	13
Bryan—copper wire, amalgamated.....	36	39	Plate 2 1/2" d., 1" hole in it.	0000	2	.000071	9
Plastic cork.....	9	..	Surface 1 1/2" d.	..	..	.0006	8
Solid rail—no joint.....	18	There	were holes in web.	..	..	.000013	..

NOTE.—Tests made on Pennsylvania Steel Company's 7-inch girder rail, No. 238. A resistance of bond. B resistance of joint only.

bond has a resistance of 53 per cent. of the Crown (neither amalgamated).

* Paper read at the Franklin Institute meeting, Philadelphia, Nov. 1, 1897.

while the Columbia type is only benefited slightly. In both instances the Columbia is the better bond.

- (6) Iron-wire bonds are highly inefficient.
- (7) Any method of testing wherein drop in poten-

tial is measured from the same contacts through which current flows to make measurements lead to false readings, as the measurements include the drop in the contacts.

THE INSULATION OF ELECTRICAL TESTING INSTRUMENTS.*

BY J. WRIGHT.

The importance of efficient insulation for testing instruments cannot be too strongly impressed on those who include electrical testing in their category of daily duties. Without it, accurate results are an unknown quantity, and, in fact, with some testing installations the writer has come across it is a wonder that the users were able to obtain any results at all. When one comes to consider the extreme sensitiveness of that delicate instrument, the Thomson reflecting galvanometer, the necessity for efficient insulation comes as a matter of course.

These instruments are practically built on an insulating basis; nevertheless, their feet should be mounted on insulating pedestals of some description. A very good form for this purpose is that shown in Fig. 1, which represents a plan and cross-sectional elevation. It is a disk of hard rubber or ebonite about 1/2 in. in thickness, and in the upper face of which is turned a semi-circular groove or channel, A, about 3/4 in. wide. Into this is poured hot, molten paraffin wax of the pure white variety. It is allowed to harden, and is then pared off flush with the

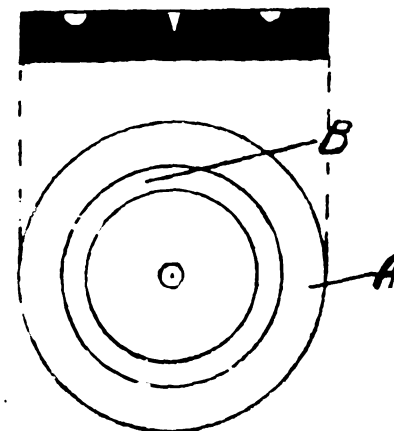


FIG. 1.

ebonite. In the center of the ebonite disk is turned a small conical depression to receive the point of the leveling screw of the galvanometer. These disks form a very effective insulation, but they require to be kept clean and free from dust, which by settling on the wax lowers its insulating properties. In order to ensure a clean surface on the wax, the groove, B, should be periodically scraped out and refilled with fresh wax.

The foot described above is sufficient for all ordinary purposes, but an insulator with higher insulating properties still has been designed, and is illustrated in Fig. 2, which represents a cross-sectional elevation. A is, as before, a cylindrical block of ebonite, with a channel, B, turned in it to contain a resin oil. As will be seen from the figure, the channel is infinitely better protected in this case from dust than previously; the center of the block, rising as it does in the form of a pedestal, practically covers in the whole of the oil-containing vessel. It will be noticed also that the exterior walls of the cylinder at C are ribbed, the object of such corrugations being to increase the area of insulating surface on the ebonite. The oil is introduced into the channel, B, of these insulators by means of a special siphon tube constructed for the purpose.

It must be borne in mind that all ebonite pillars and blocks used for the insulation of testing apparatus depend for their insulating properties on the area of their surfaces. Take an example, as in Fig. 3, which represents an ebonite cone of the form some-

* From the *Electrical Engineer*, London.

times used to support the contacts of battery and galvanometer. Keys *a* and *b* represent screw holes tapped in the ebonite to take the fittings. The insulating surface between the metallic screws, *a* and *b*, will then extend over the exterior of the cone as shown by the arrows, so that to bore the screw holes completely through the center of the block would be to rob it of 75 per cent. of its efficiency as an insulator, the surface then only extending from *a* to *b* direct, as well as running the risk of contact between the screws if not cut sufficiently short.

Where necessity compels the setting up of an installation of testing instruments in a damp locality, it is as well to cover the whole table or bench in the first instance with a piece of gutta percha or ebonite. Wherever possible, a room should be selected which can be warmed by a dry heating process, and kept at as even a temperature as possible both day and night. It is a good plan to proceed as follows with regard to the fixing of such apparatus as keys and others which require permanent fixing. Instead of screwing them to the wooden base, which has the disadvantage of detracting somewhat from their insulating properties, let them be well secured by a layer of molten Chatterton's compound on the underside of their bases. This makes a capital cement for the purpose, and has the additional advantage of being proof against moisture.

As regards the testing battery, which is certainly not least in importance, this requires very careful treatment, especially if set up in a fixed position, as

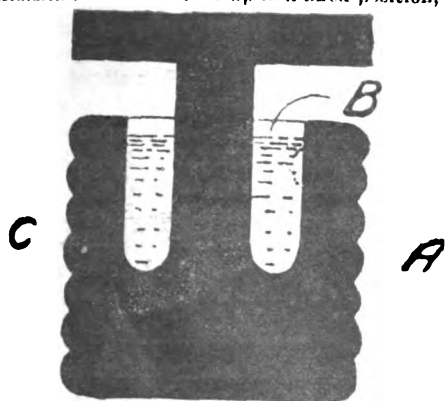


FIG. 2.

all the good points gained in other respects will be lost if the insulation of the battery itself be defective. They should be set up in a room apart from the instruments, which has the advantage of a dry atmosphere. A convenient number (say 20 cells) may be mounted together, on dry, well-seasoned wooden shelves, open to the air on both sides, and covered over all with a coating of shellac varnish. Each shelf should be mounted on a set of insulators similar to those illustrated in Figs. 4 and 5, the former of which is the type generally employed for insulating a battery of accumulators. It consists (Fig. 1) of two portions, A and B, both made in thick green glass. The lower one, A, is a kind of circular tray, carrying a ring of insulating oil, C, and supporting at its center the upper piece, B, which takes the form of an inverted cup, and supports in its turn the shelf to be insulated.

The second form of oil insulator suitable for the purpose is that illustrated in cross-section in Fig. 5, and is manufactured by Messrs. Johnson & Phillips. A is the porcelain body, and B the usual insulator bolt, C being the oil channel. These are very efficient insulators, and the fact is clearly proved by the following experiment, which was performed by the writer on one of this type before the introduction of the oil. The porcelain body having first been thoroughly well warmed, it was immersed to within a 1/2 in. of the rim in water. The high-tension side of a step-up transformer was then connected on one side to the central bolt, and on the other to the water. A gradually increasing voltage was applied, the maximum being 15,000, but no impression whatever was made upon the insulator, which came out of the bath as sound as when it entered. Any cells

showing a disposition to leak or "creep" should be at once removed and replaced by new ones, as they give rise in time to a pool of liquid electrolyte on the shelf which, if allowed to accumulate, not only promotes leakage from cell to cell, but is also liable to flow down over the supports and impair their insulating properties.

Another important point to be observed in the setting up of a testing installation is the class of wire

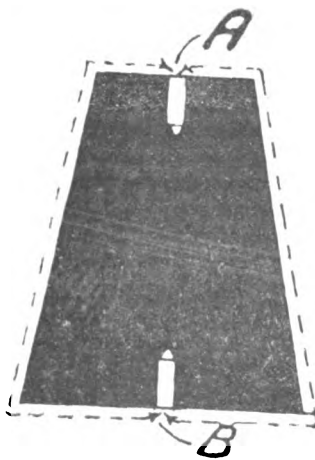


FIG. 3.

used for connections. This should in all possible cases be gutta-percha covered, as surface leakage over the insulation will then be reduced to a minimum. If, however, no wire of this class be attainable, the ordinary vulcanized india-rubber-covered wire should be used, the ends having been in the first instance carefully prepared as follows: Strip back the braiding by means of a sharp knife for some 3 in., taking care not to injure the rubber underneath in any way. Next proceed to unlap the proof tape for the same distance. If any difficulty be experienced in getting the tape to leave the rubber, it may be overcome by saturating the tape with coal-tar naphtha. This may be effected by passing a rag soaked in naphtha backwards and forwards over the tape; it will then leave the rubber with ease, and the surface of the latter should then be scraped clean of any impurities. The copper conductor is then bared of rubber for a distance of about 1 in. from the end, and the extremity of the rubber pared down after the manner of sharpening a lead pencil, thus exposing a clean surface of freshly cut rubber. The ends having been thus far prepared are immersed for the space of a few seconds in hot melted paraffin wax, which, when cool, forms an efficient insulating film against surface leakage. Rubber-covered wire prepared in this manner is very nearly, if not quite, as good for the purpose as gutta-percha-covered conductors; the latter are, however, to be recommended in preference, as they are much less trouble to prepare, and are absolutely proof against surface leakage. This treat-

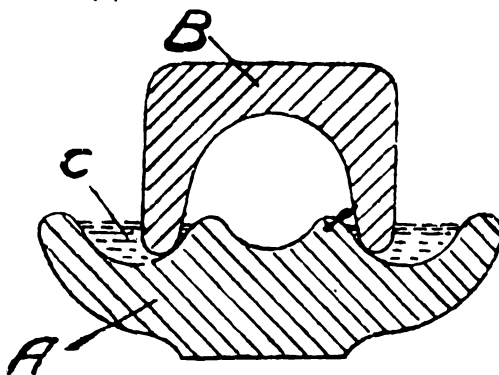


FIG. 4.

ment of connecting wires also applies, of course, to all exterior leads used in connecting up the subject to be tested. It is not a bad plan to give the ebonite portion of testing instruments, keys, and other apparatus a periodical polish with a rag saturated in paraffin oil, any excess of the latter being afterwards removed by the application of a clean, dry cloth. This not only removes any accumulation of dust and

dirt, but also envelops them in a film of liquid which has high insulating properties.

The matter of insulation in high-tension work, when voltages of 1,000 and upwards are employed, is of even greater importance, not so much in this case for accuracy's sake as in the risk to life and limb. The cases of transformers, high-tension switches, and recording instruments should, if metallic, be, if possible, earthed, and if not, should at any rate be sufficiently protected to prevent personal contact. As regards the handles of high-tension switches, these should be constructed of fairly thick ebonite, and an element of safety is introduced by the addition of a disk of the same material some 3 in. or 4 in. in diameter around the handle of the active lever at the point where it merges into metal. Some high-tension switches, more especially those which are semi-automatic in their action, are provided with two cords, the act of pulling one or the other of which actuates the switch. Such methods are not to be advocated, however, as they have several drawbacks. In addition to the difficulty of effectually manipulating a cord, there is also the risk of breaking at a critical moment. The writer's idea of a switch for high-tension work is one with a long and well-insulated lever handle actuating a quick-break system, there being a certain amount of satisfaction in working such a piece of mechanism.

When the voltage exceeds 5,000 it is advisable to use oil-insulated transformers, which are far less liable to break down and give trouble, and even if

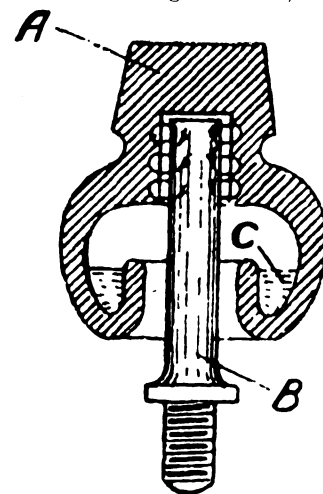


FIG. 5.

they should "blow out" by any means, it as a rule only necessitates shutting down for a short period to allow the oil to settle and thereby clear the fault. The best oil for the purpose is thick resin oil of the consistence of treacle.

The use of rubber gloves in high-tension work is a thing to be avoided. It gives rise to a false feeling of security, and may lead eventually to carelessness. There is no absolute safety in handling a live lead through the medium of rubber gauntlets. One never knows from one minute to another how perfect the rubber may be. It is always better, therefore, if absolutely necessary to manipulate a live lead, to do so at the end of a substantial bar of ebonite, some 3 ft. or 4 ft. in length; or another plan is to slip a piece of ebonite tubing, about 1 ft. long, over the lead, and utilize it as a handle by which to support the latter. When experimenting in high voltages, one is apt to be startled at first by the suspicious sound caused by static discharges across the highly-charged terminals of the transformer and other apparatus. It is not unlike the buzzing of a fly, and is, as before mentioned, somewhat alarming to the novice, who usually at once suspects a leak or a break-down of some kind. It need not, however, be taken into consideration, as it is merely due to static effects and has no influence on the actual circuits.

In concluding this article, the writer ventures to hope that it may contain matter of interest to those whose duties are included under the title of "electricians."

THE NEW YORK ELECTRICAL SOCIETY.

On the 12th inst. the New York Electrical Society held its 184th meeting at the College of the City of New York, where most of this season's meetings of the Society will be held.

Mr. S. Dana Greene read a valuable and interesting paper on "The Relations Between the Customer, the Consulting Engineer, and the Electric Manufacturer."

A discussion of this paper followed in which Messrs. Max Osterberg, Gano S. Dunn, C. O. Mailloux, H. B. Coho and Drs. C. E. Emery and F. B. Crocker took part.

The following resolution on "Standardization" was presented and adopted:

Resolved, That in view of the excellent suggestions and recommendations on standardizing apparatus embodied in Mr. S. D. Greene's paper, the Society hereby expresses its approval of efforts in that direction, and invites the American Institute of Electrical Engineers to consider some comprehensive plan for such standardization of American apparatus for electric light and power.

The following were elected to membership in the Society:

Otto Rothenstein, Otto Electric Company, Times Building, New York City.

F. K. Vreeland, 228 Orange Road, Montclair, N. J.

F. V. Henshaw, 79 State street, Brooklyn, N. Y.

S. L. Griswold Knox, Crocker-Wheeler Electric Company, Ampere, Newark, N. J.

John Neilson, superintendent Larchmont Electric Company, Larchmont, N. Y.

Putnam A. Bates, 113 West 72d st., New York.

E. E. Higgins, 26 Cortlandt st., New York.

Thomas A. Edison, 96 Broadway, New York.

THE ELECTRICAL EXHIBITION.

At the request of the President, the Secretary read the following announcement:

"For some time past the New York Electrical Society has been considering means for enlarging its scope of usefulness, and addressing a larger clientele among the citizens of New York, so as to bring the public into more intimate relations with the scientific aspect of all classes of electrical work. The proposition to hold an Electrical Exhibition at Madison Square Garden next May appeared to the Society to afford it the needed opportunity for putting itself prominently before the public as the oldest electrical body in the country, and the recognized local Society, aiming by papers and discussions to diffuse the best electrical information.

"The Electrical Exhibition has very promptly and generously met the views of the New York Electrical Society, and has not only apportioned its space in the Exhibition Hall for a booth and rendezvous for its members and friends, but has also placed at its disposal a contribution of funds for its educational work. This amount will be increased by a percentage of the admission receipts of the Exhibition, which is to be held under the auspices of the New York Electrical Society. Members of the Society will be admitted to the Exhibition at half price.

"It is believed, from what is already known, that this Exhibition will surpass anything of the kind ever done in this city, and will during the continuance of a month not only do much to promote electric interests, but enable the Society to reach a great many thousand people who should know of its work, and many hundreds who should unquestionably be in its membership.

"The Electrical Society is now organizing committees and laying plans for a hearty and active co-operation in the work of the Exhibition, and looking, of course, to its own increase of membership and its fuller recognition as an authoritative, influential body.

"It is hoped and expected that this will mark the beginning of one of the most successful moves ever undertaken by the Society, and approving comments of friends and members encourage the

executive committee to believe that they will be enthusiastically supported in the programme, the sole object of which is to increase and extend the Society's usefulness. The officers would, therefore, not only urge the members of the Society, individually and collectively, to assist in making the Exhibition as brilliant a success as possible for the direct benefit that such success will confer on the Society, but also wish to impress on members the desirability of active co-operation with a view of increasing the membership (a membership which now standing at four hundred, should be at least a thousand before the year is out).

"It has been suggested that the Advisory Committee of the Society, representing its interests with the officers of the Exhibition and for other Exhibition purposes, should consist of the present officers and all the living ex-Presidents, namely: Frank W. Jones, John M. Pendleton, Dr. F. B. Crocker, Joseph Wetzler, C. O. Mailloux, John W. Lieb, Jr., Dr. C. E. Emery, all of whom, it is understood, will gladly co-operate in this movement to develop work to which they themselves have so actively contributed in past years."

The following resolution was put to the meeting and adopted:

Resolved, That having heard the report of the officers of the Society in regard to the arrangement effected for co-operation with the approaching Electrical Exhibition in this city, the members hereby express their hearty approval and pledge themselves to active work, that shall make the most of this opportunity for promoting the interests of electricity and the welfare of the Society.

CONGRESSIONAL NOTES.

A bill is before the House to establish engineering experiment stations in connection with the colleges established throughout the United States, where investigations and researches may be carried on relative to the principles and applications of the various branches of the science of engineering and of naval architecture; to aid the Navy Department in its researches, to enlist the co-operation of builders, manufacturers and industrial establishments in the prosecution of such experimental work as will secure to the naval service the best material, the highest type of motive power and other machinery and accessories for war ships and other naval vessels; to aid States and Territories in the experimental determination of the composition and value of their minerals, fuels, constructive materials and other resources, as well as the scientific and economic questions involved in the utilization of raw materials and the development of water, steam and electric power in the production of manufactured products; and to this end it is asked that an appropriate amount be set aside from year to year by the Government for the furtherance of such an idea.

Representative Bennet has introduced a bill to provide for a contract between the Government and the Pacific Cable Company of New York, whereby for the sum of \$125,000 per year, payable quarterly, for twenty years, official communication may be maintained between the United States and Honolulu in the Hawaiian Islands either by means of electrical or other methods, through a submarine cable or cables and connecting land lines; also to Japan and Australia.

It is proposed to regulate the charges for telephone service in the District by means of Congressional regulations, which would place a charge of \$25 per annum for telephones in private houses, \$35 for those put in business houses, and \$50 per annum for all telephones placed in hotels. The bill carries with it a provision for a fine of \$250 for each and every contract that should be made for charges in excess of the amounts named above.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

Dr. Herz's Claim for Indemnity.

We learn from the Washington *Star* that counsel for Dr. Cornelius Herz have presented to the State Department a claim for indemnity in the sum of \$5,000,000 against the French Government for alleged persecution. In announcing this fact the *Star* says: "Dr. Herz stands high in scientific circles as an electrician and physicist. Although born in France, of French parents, he is an American citizen. Young Herz was educated in the New York Free Academy and at Heidelberg and other great European universities. Meanwhile his fame as an electrician had spread and he did much to extend the study of this branch of science. He married an American woman, and when his children were born in Paris he caused them to be registered as American citizens."

"January 19, 1893, his troubles began. He was in Bournemouth, England, with his wife, in bad health, when he was arrested under extradition proceedings on a warrant from the French Government charging him with fraud and embezzlement growing out of the Panama Canal scandal. The case was kept open and he was continued under arrest in his bed four years. Then the British Parliament came to his relief and passed a special act that permitted the magistrate to attend Herz's bedside and take his testimony. This was done and the magistrate promptly declared that the charges were utterly invalid. That was on May 2, 1896, and Herz was released from arrest. Meanwhile the French Government had instituted numerous proceedings against him in France and confiscated all of the property of himself and of his wife. Dr. Herz alleged that this was persecution pure and simple and that the French Government knew that the charges against him were baseless before his trial. Therefore, claiming to have been injured in name and health and in other ways, he demands that the State Department shall prefer a claim against the French Government in full reparation.

"The State Department has taken the case under advisement."

The Brush Electric Light Stock Suit.

The Savannah *News* of the 8th inst. says: "There will probably be no settlement of the bail in trover suit involving the ownership of the fifty shares of Brush Electric Light & Power Company's stock, sent here some time ago for the purpose of having the dividends collected through the Southern Bank.

"Mr. George T. Hanchett of Hackensack, N. J., who sent the stock to Savannah for the collection of back dividends, has sent a list of his witnesses to Messrs. Mercer & Mercer, and has given every indication that he will defend his title to the stock to the end. Among his witnesses is Dr. Elroy M. Avery of Cleveland, O., from whom he secured the stock. Dr. Avery secured it from the Cleveland company, along with other shares which were long ago turned in to the Savannah company. It is understood Dr. Avery holds that Mr. Hanchett's possession of the stock is bona fide and legal, and every effort will be put forward to make that showing when the case comes up.

"The value of the shares with the dividends due amounts to something like \$12,000, as it has been years since any dividends were collected. It was thought some time ago that a settlement in the shape of a compromise would be made, and Messrs. Saussy & Saussy had a consultation with Messrs. Mercer & Mercer looking to that end. Mr. Hanchett, it appears, however, does not want any compromise, and the case will no doubt go to trial in the City Court."

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

International Competition for the Phebe Hearst Architectural Plan of the University of California.

The trustees of the Phebe A. Hearst architectural plan of the University of California have issued their invitation to the architects of the world to co-operate "in the preparation of a permanent general plan of the buildings and grounds which are to compose the University of California."

The invitation is in the form of a handsomely printed pamphlet of forty pages, entitled "Programme for an International Competition for the Phebe Hearst Architectural Plan of the University of California." It opens as follows:

"The trustees appointed by Mrs. Phebe A. Hearst hereby invite the co-operation of the architects of the world in the preparation of a permanent general plan of the buildings and grounds which are to compose the University of California, in Berkeley, near San Francisco, Cal."

The competition is to be double, a preliminary and final. The preliminary is open to the world. The final will be limited to those whose work in the preliminary is decided by the jury of award to be of such worth and merit as to entitle them to be considered in the final competition. All plans submitted for the preliminary competition must be deposited with the United States Consul at Antwerp, Belgium, before July 1, 1898.

Rules have been adopted so that the members of the jury of award will not know who is the author of any plan. All plans that the jury do not consider worthy of being retained will be returned to their authors. The plans retained will become the property of the University of California, but the name of a successful author will not be made public without his consent. At least ten plans will be retained, and if only that number the author of each will receive \$1,500. If not exceeding fifteen plans are retained \$1,200 will be paid to each, and if more than fifteen are retained \$1,000 will be paid to each.

Competitors in the final competition who desire to study the site of the proposed buildings on the ground will be provided with transportation and expenses for the journey from their residences to San Francisco and return. A total sum of at least \$20,000 will be devoted to premiums for the best plans in the final competition, and of this at least \$3,000 will be awarded to the plan classed as No. 1.

The jury for the preliminary competition will be international, being composed of these members: Messrs. R. Norman Shaw, 6 Ellerdale Road, Hampstead, London; J. L. Pascal, 8 Boulevard St. Denis, Paris; Paul Wallot, 6 Hahnel-Strasse, Dresden; Walter Cook, 674 Broadway, New York, N. Y.; J. B. Reinstein, 217 Sansome street, San Francisco, Cal. For the final competition four architects will be added to this jury, who will be chosen by its members, aided by lists of names submitted by successful preliminary competitors.

The general grouping of requirements includes a library with a capacity for 750,000 volumes, a gymnasium with separate halls and appurtenant accommodation for men and women students, and separate swimming baths for each, two auditoriums, of which one shall seat 5,000 people, dormitories, club-houses for students and faculty, an elaborate military establishment; an infirmary, and all suitable structures and provisions for the fifteen departments thus far contemplated by the University.

Requests for further information may be addressed to Trustees Phebe Hearst Architectural Plan, University of California, 217 Sansome street, San Francisco, Cal.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Supreme Court of Louisiana held, in the case of Malochée vs. Great Southern Telephone and Telegraph Company, that where a subscriber for telephone service, in default of payment stipulated for the service, was notified by the telephone company that the telephone instruments would be removed from his premises unless he paid the amount due, and he replied that the telephone company could do as it pleased, he had no claim for damages because the instruments were thereafter removed by the company, the written notice of the removal specified in the contract being regarded as wholly unnecessary and as having been waived.

On the bill of complaint filed in the United States Circuit Court at Galveston, Tex., by the Massachusetts Loan & Trust Company against the Citizens' Electric Light & Power Company of Houston, Judge Bryant has issued an order appointing Blake Dupree of Houston receiver of the company. The Massachusetts Loan & Trust Company is the holder of 150 first mortgage bonds of the company of the denomination of \$1,000 and bearing interest at the rate of 6 per cent. per annum. The company has defaulted on the interest on these bonds since September, 1896.

Judge Woolson has signed and filed a decree in the Federal Court at Keokuk, Ia., ordering the sale of the Ottumwa Electric Railway. The court orders a mortgage for \$236,000, with interest from December 1, 1897, foreclosed, and the property sold within thirty days. The Illinois Trust & Savings Bank, trustee, was the complainant.

The case of the Thomson-Houston Electric Company, complainant, appellant, vs. the Athol Orange Street Railroad Company, defendant, appellee, was before the U. S. Circuit Court of Appeals in Boston last week. The suit was originally brought on alleged infringement of patent No. 446,260 for an improvement in electric motor suspension, issued to E. W. Rice, Jr., March 17, 1891, and also upon patent No. 470,817, granted to F. O. Blackwell, March 15, 1892, for an improvement in electric motors. Decision was reserved.

The Supreme Court of the United States held in the recent case of Hyer vs. the Richmond (Va.) Traction Company et al., that a contract between promoters of rival street railways competing for the grant of a franchise from a city council whereby the ordinance of one company is withdrawn in favor of the ordinance of the other, the promoters of the two companies agreeing to co-operate in securing the franchise in the name of one and to divide equally whatever may be realized from the enterprise, is not necessarily null and void on grounds of public policy.

A verdict for \$10,500 was secured about a month ago by Willis Kimball of Charlestown from a jury against the West End Street Railway for injuries received on June 17, 1896, in a collision of cars. The defendant admitted its liability at the trial, so that the only question submitted to the jury was one of damages. After the verdict was given the defendant moved to set it aside as excessive. This was argued at considerable length, and on December 22 Judge Hammond entered the following order: "All above \$6,500 is excessive; verdict to be set aside, unless on or before January 5, 1898, the plaintiff file in the clerk's office a writing remitting all above that sum." The plaintiff has accepted the reduction, and has taken \$4,000 less than his verdict. "This order of the Court," says the Boston Transcript, "is interesting as it is made in pursuance of chapter 472 of the acts of 1897, which provides that in civil cases in which any questions or issues are submitted to a jury, no verdict shall be set aside as excessive unless the prevailing party is first given an opportunity to remit so much of the verdict as the Court shall adjudge to be excessive. The testimony of the medical men called in this case was particularly interesting, the issue being whether plaintiff had an impacted fracture of the hip, with bruising of the pelvic bone, or whether his injuries were severe and painful bruises and chiefly muscular. At the hearing on the motion, Judge Hammond stated that if he should come to the conclusion that the hip bone was broken he should not reduce the amount of the verdict."

CANADIAN NOTES.

One of the commercial sensations of the year at Montreal was created when it was announced that hereafter the Montreal Electric Street Railway would not only pay its dividends quarterly but would increase them to 2½ per cent. quarterly. The stock is now quoted at 243½, having risen 7½ points immediately when the increase of dividends to 10 per cent. per annum was made known.

An electric horn has just been placed upon the market here which is capable of making a prodigious noise and sounding much like a marine fog horn. This electric horn is the invention of Mr. A. Trudeau of Ottawa. The need of a horn of this kind suggested itself to Mr. Trudeau after the disastrous fire at the Ottawa College, where a serious calamity might have taken place had the fire occurred in the night time. These horns of a specified size may be utilized as a fire alarm for waking pupils in dormitories, or in the morning, of scholastic institutions or for any purpose where a whistle might be used where there is an electric current available. The horns can be placed in different parts of a building and all set tooting at once by turning on the current.

An increase of \$500 per day in the receipts of the Toronto Street Railway over the figures of a short time ago is a subject of much favorable comment. To the invention of a Toronto citizen, Mr. Michael Power, master car builder of the Toronto Electric Railway Company, there may fairly be given credit to no inconsiderable extent for this improved condition of affairs. Mr. Power is the inventor of the Power track cleaner and digger—a little knife-like device that bobs up and down on the car rails and removes snow, ice and other obstructions. It has worked so effectively that so far this season there has not been any occasion to bring out the ugly sweepers that in the past cleared the track from snow, to the disgust of pedestrians and annoyance of people living along the line of railway and the frightening of horses.

Henry Electrical Society.

The next meeting of the Henry Electrical Society will be held at Columbia University, Engineering Building, Room 302, on Friday evening, January 21, when Mr. D. R. Lovejoy will deliver a lecture on "The Induction Coil and High Potential Discharges."

The lecture will treat of the practical design of the induction coil, and will be illustrated by many experiments showing the various effects obtainable.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

GENERAL NEWS.

What Is Going On in the Electrical World.

Albany, Ind.—The town board has decided to establish a municipal electric lighting plant at a cost of \$20,000.

Anderson, Ind.—It is understood that Superintendent Blizard of the Big Four favors trying the third-rail electric system on that line between Anderson and Marion to meet the service and rates of the new Indiana Gas Belt Electric Railway which parallels the Big Four from Anderson to Alexandria. The Indiana Gas Belt Electric Railway Company is now running its trains as far as Alexandria by regular schedule. Trains run each way every hour. The coaches are the same length and breadth as the ordinary railway coaches, are elegantly upholstered with seats running across instead of lengthwise. There are baggage, mail and express departments, the platforms are vestibuled, the lighting and heating by electricity, and in fact, everything is as complete as a Pullman train.

Buffalo, N. Y.—H. G. Stott, the electrical expert of the Buffalo General Electric Company; L. B. Stillwell, the electrical director of the Cataract Construction Company; Calvert Townley of Pittsburgh, the electrical engineer of the Westinghouse Company, and W. R. L. Emmet of Schenectady, the expert electrician of the General Electric Company, were here a few days ago and held several conferences with officials of the Cataract Company in regard to machines, delivery of power,

etc. The schedule of rates for power will be announced this month.

Chicago.—Representatives of about fifty street railways in all sections of the State met here on the 5th inst., and formed an association for closer co-operation and mutual aid in advancing the interests of street railways throughout the State. The following officers were elected: President, W. H. Patterson, Bloomington; vice president, L. Sherwood, Elgin; secretary and treasurer, T. J. Minary, Springfield; executive committee: W. H. Patterson, C. K. Minary, L. Sherwood, W. L. Ferguson, Decatur; B. F. Harris, Champaign; J. Barker, Peoria, and W. F. Brennan, Chicago.—Alderman Powers has introduced an ordinance providing for an extensive subway system to be constructed by a company headed by George W. Jackson, who has built most of the subways of Chicago. In exchange for carrying the city's water mains and electric wires the ordinance carries a franchise covering the city between the lake, Ashland avenue, Division street and Twenty-second street. The company proposes to put down a subway in each street of the district sixteen feet square in which to carry every water and gas main, all electric light, telegraph and telephone wires, and all pneumatic tubes. The corporations now using space under the city streets are to rent space in this subway and save the sums they now spend for tearing up and replacing the pavements. It is estimated that the building of the subways would take seven years, and that they would cost about \$20,000,000.

Clarinda, Ia.—An election will be held here on the 31st inst. to decide whether a ten-year contract for electrically lighting the city will be closed with John H. Packer.

Columbus, O.—The House, without a dissenting voice has repealed the law permitting fifty year franchises to street railroads.

Columbus, Ga.—The Columbus Power Company has completed its organization by electing the following officers: President, H. M. Comer, president of the Central Railroad; treasurer, G. Gunby Jordan; directors: J. F. Hanson and John Hill. The capital stock was increased to \$200,000. The company owns the famous "Lovers' Leap" water power just north of Columbus, and will at once begin building a stone dam across the river and erect a plant for furnishing electric power for manufacturing industries.

Dallas, Tex.—C. H. Alexander last week bought the entire property of the Queen City Electric Street Railway from G. W. Davenport, of Boston. Mr. Alexander recently purchased the Dallas Consolidated Electric Light plant, and chartered the Standard Electric Light, Heat & Power Company. His aggregated transactions in these lines during the last sixty days involved almost \$2,000,000. Seven years ago he was working on a small salary.

Dawson, Minn.—An electric light plant has been put in here by G. H. Simons of Montevideo. The enterprise is the personal effort of A. Thompson of this place.

Delta, Col.—T. C. Dobbins, a Telluride electrician, is negotiating for the electric light franchise recently granted by the Delta city council to W. R. Gale. It is understood that if Mr. Dobbins secures the franchise he will at once commence work on the plant.

Denver, Col.—The Colorado Midland Railroad Company is considering the idea of adopting electricity for lighting its cars by means of a current generated by dynamos attached to the trucks of the cars. It is likely that the Denver & Rio Grande and the Gulf roads will also adopt this system of lighting.

Downingtown, Pa.—The Citizens' Light & Power Company was organized here on the 14th inst., and \$10,000 of the capital stock was subscribed. The company will erect a light and power plant in East Downingtown, and will build a trolley line between Downingtown and that suburb.

Elizabeth, N. J.—The scheme of building a trolley road between Elizabeth and Plainfield at the county's expense has been defeated by a vote of 10 to 7 in the Union county board of freeholders.

Elyria, O.—The Wellington electric light plant has been sold by the sheriff under direction of the court to satisfy claims. The property was bid off by Wellington parties for \$6,335.

Englewood, N. J.—The Bergen County Traction Company, which now operates a trolley line from Fort Lee Ferry to Englewood, N. J., is in active negotiation with the Leonia and Bogota borough councils and the Teaneck township committee for right of way that will permit it to extend its line across country from the easterly boundary of Leonia to Hackensack.

Fort Scott, Kan.—The electric car system in this city, which for a number of years has been owned and operated by the Fort Scott Rapid Transit Railway Company, has been transferred to the Citizens' Railway Company, which is now in control. The new company's officers are: President, Grant Hornaday; vice-president and general manager, W. H. Frost; treasurer, C. B. McDonald; secretary, J. H. Crain. An appropriation has been made by the stockholders for a thorough overhauling of the system. New steam and electrical machinery will be put in in order to take advantage of the light and power franchise recently granted the old company. The new company will also attempt to secure the contract for the city lighting.

Glens Falls, N. Y.—E. L. Ashley has purchased the electrical equipment of the Glens Falls Gas Company and intends to remove it to Kane's Falls. Mr. Ashley purposes making the plant large enough to supply the village of Fort Ann, a mile and a half distant, with about 1,000 incandescent lights and thirty arc lights.

Hadley, Mass.—The selectmen have voted to grant a franchise to the Northampton & Amherst Railway Company to build an electric railroad in Hadley along the State road from the Hadley bridge to the Amherst town line.

Hartford, Conn.—The New England Railroad Company intends at an early date to extend its third-rail electric system from New Britain to Bristol, which will give the latter city connection with Hartford by this system of rapid transit, as there is a line of it already in operation from New Britain to Hartford. The total distance is about 18 miles.

Holyoke, Mass.—The city having voted at the recent election to take the gas and electric lighting plants, the water power company, which owns both, has filed with the city clerk a demand for \$1,000,000 for them, and an annual rental of about \$25,000 for the water power, in addition to cost price for the supplies on hand. The company is capitalized at \$1,200,000 and its entire property appraised by the city at \$2,200,000. The actual selling price will be determined by a commission.

Laconia, N. H.—The stockholders of the Laconia Street Railway Company have about decided to equip their road for electric power. The road is one of the few in New England now using horses for motive power.

Lewiston, Me.—One of the plans of the big electric railroad syndicate recently organized here is to unite the Lewiston & Auburn, the Brunswick & Topsham and the Bath street railroads, and a preliminary survey has been made with this in view. The road will start from the foot of Lisbon street in this city, and run through the towns of Lisbon, Lisbon Falls, to Brunswick, thence to Bath by way of New Meadows. The system, when completed, will have a mileage of more than twice that of any other street railroad in Maine. One plan in the scheme is to lay out a large and magnificent park at a beautiful place at New Meadows, where there will be a theater and everything which the people will desire in the form of recreation. It is planned to make this place the great pleasure spot of central Maine.

Meadville, Pa.—The proposed route for the electric railway from this city to Edinboro has been approved by the engineers. It will go through to Edinboro, as originally intended, via Saegertown, Venango and Cambridge Springs, with important improvements at Conneaut lake, Edinboro, such as will make it a desirable summer resort and especially attractive for excursion and picnic parties. Conneaut lake is a very attractive spot, and the company expects to make it a Mecca for pleasure seekers during the summer seasons.

Metuchen, N. J.—The New Brunswick "Fredonian" says: "It is given out on good authority that a syndicate of capitalists have in view a scheme similar to that which the Middlesex Water Company conceived and executed for the supply of water, except that what they will supply will be electric lighting over nearly the same territory in Metuchen and Raritan Townships. It is said that the project includes an extensive plant to be situated between Metuchen and the Raritan river, so as to be central to the towns and boroughs to be lighted. These include Metuchen, Woodbridge, Sewaren, Carteret, Maurer, and the clay works at Ostrander's, Keasbey's, etc., on this side of the river, and South Amboy on the other side."

Milford, O.—The Cincinnati "Enquirer" states that there is a strong probability that Cleveland capitalists will become financially interested in the project to build an electric railroad from Cincinnati to Milford and Terrace Park, and that it will be built if the people along the route subscribe for a reasonable amount of stock.

Milwaukee, Wis.—The Cloos Electrical Engineering Company has been organized here to manufacture and sell the Cloos safety, economical and electrical devices, with these officers: Herman W. Falk, president; Jacob Cloos, vice-president; E. A. Wurster, secretary; H. R. King, treasurer. Mr. Cloos, the inventor of these devices, was formerly chief engineer of the Pabst Heat, Light & Power Company. These devices are only for the controlling and operation of high potential alternating and direct work.

Mineola, Wood Co., Tex.—Mr. Tilley of Jacksonville, Tex., has signed contracts with the citizens of Mineola for nearly 300 lights, and will establish an electric light plant here.

Montclair, N. J.—The town council in a secret conference is said to have agreed to give a franchise to the North Jersey Street Railway Company to run its cars in Bloomfield avenue and thus complete its line from Newark to Caldwell, but the anti-trolley people propose to prolong the fight, which has extended over many months, as soon as the company presents its formal acceptance of the terms of the franchise and the matter is brought before the council for final action.

Newark, N. J.—The Newark & South Orange Railroad Company and the North Jersey Traction Company have consolidated, and the new company will control all of the roads in Essex County except those of the Consolidated Traction Company. A number of extensions of the lines of the amalgamated companies are in contemplation, the most important being from Irvington to Hilton and from Maplewood to Millburn and Springfield.

New Haven, Conn.—The annual report of the Connecticut Railroad Commissioners shows that there are 385 miles of trolley road in the State, an increase of about 32 miles over last year. The 29 trolley roads have \$9,770,440 of the stock issued, of which only \$3,106,940 has been issued for cash. Their bonded debt

is \$9,092,800, and floating debt \$1,071,421. They carried last year about 43,000 fewer passengers than they did in 1896. They paid in dividends \$265,625, as compared with \$221,119 in 1896.

New York.—Although the local daily papers have several times stated that the contract for equipping the Manhattan Elevated road with electricity has been let to this or that company, the fact is, as far as we can learn, that the Manhattan people have not as yet applied to the Railroad Commissioners for permission to change the motive power, and have not decided upon any particular system although the subject is under consideration. The best information is that when the contract is let it will be divided between two or three of the big manufacturing concerns, with the Walker Company in the lead on account of certain influences, personal and political.

Niles, Mich.—H. A. Chapin & Son, the millionaire mine owners of this city, are talking of building an electric railroad between Niles and South Bend, Ind. The specifications are already drawn. Chapin & Son own the South Bend electric light plant, and if they build the road power will be derived from this plant.

Nyack, N. Y.—The Nyack Traction Company has been granted a franchise to run its cars in Piermont.

Piedmont, W. Va.—At the election here on the 6th inst. the ticket favorable to electric lights was elected, and a plant will be put in.

Rochester, N. Y.—A trolley railway line is contemplated to extend from Rochester to Craig Colony, Sonyea, by way of Avon, Mt. Morris and Nunda. Rochester capitalists are interested in the project.

Rockville, Conn.—The longest continuous trolley line in the State, that between Hartford and this city, was opened on the 8th inst., with an hourly service, the running time being an hour and a half and the fare 20 cents. The length of the line is 17 miles and it is in effect a parallel of the line of the New England Railroad Company.

St. Louis.—The new Missouri-Edison Company has absorbed the St. Louis Electric Light & Power Company. The deal places the Missouri-Edison Company in almost absolute control of the electric lighting business of St. Louis.

Tacoma, Wash.—Charles B. Hurley, of this city, has acquired a controlling interest in the electric lighting plant at Skagway, Alaska, owned by Charles Phelps, and has made arrangements for increasing its capacity and extending the service to Dyea. The electrical plant now at Skagway has a capacity of 400 incandescent lights, but when the improvements contemplated are made it will be able to supply 2,200 incandescent and 50 arc lights.

Townsend, Mass.—At a special town meeting, held here a few days ago, E. C. Tuttle, U. S. Adams, W. M. Lawrence and H. N. Spaulding were appointed a committee to consider the feasibility of providing electric lighting for the three villages of the town, either by the town or by the investment of private capital, and report at the next town meeting.

Washington, D. C.—The Treasury Department awarded the contract for putting in electric wire conduits and wires for the new electric plant of the city post-office to the Southern Electric Company of Baltimore. The bid of this company was \$20,650, and was the lowest of a number opened some time ago. The wire conduits and the wires are preliminary to the contract which will soon be let for putting in the entire electric light and power plant.

PERSONAL AND MISCELLANEA.

Thomas Behan, who for the past two years has been employed in the drafting department of the General Electric Company at Schenectady, has accepted a similar position with the Fort Wayne Electric Corporation.

A dispatch to the N. Y. "Evening Post" from New Haven, Conn., states that the repeated report that Thomas A. Edison and J. Pierpont Morgan are at the head of a syndicate which has bought the Housatonic water power at Falls Village, in Connecticut, is denied by ex-State Comptroller Staub of New Milford, who has been the owner of that and other water powers of the upper Housatonic. These water powers he purchased or leased from a Connecticut corporation chartered in 1893, and he has since made an arrangement with a New York syndicate for utilizing the Falls Village property, on which about forty five years ago \$200,000 was expended.

The Central-Hudson Railroad Company is placing electrical train indicators in leading hotels in cities through which the trains pass. The indicators will be on keyboards, and the name and number of each train on the Central-Hudson road that enters or leaves the city will be thereon. If the trains are late the number of minutes or hours, as the case may be, will be indicated by pointers. They will be so simple that any one can tell at a glance just how the trains are running. The indicators will be put in by the railroad company free of charge, it is said. A man at the Central-Hudson station will have charge of them and make changes on all the boards by merely pressing a button or two at the station. The boards are proving very convenient for the traveling public.

The Rochester, N. Y., "Herald" says: "The electrical device to be manufactured by the new Rochester Electrical Manufacturing Company is a cutout invented by Police Electrician Louis W. Miller, who has invented several such devices. He invented and placed

in the patrol boxes and fire alarm boxes a cutout that proved of inestimable value to the city, inasmuch as it has saved the citizens hundreds of dollars. It is a frequent occurrence during a storm for the wires running through the city to get crossed, and in former years when this would occur all of the boxes on that circuit would burn out. This would entail a considerable loss to the city, besides leaving a portion of the city cut off from communication with the fire houses or police headquarters. But when the cutouts were put in this expense and danger was obviated. The new cutout patented by Mr. Miller is similar to those already in operation. It is to be put in telephones, watchmen's clocks, district messenger boxes, fire alarm gongs and central office electrical apparatus."

RECENT COMPANY ELECTIONS.

Boston Street Railway, Boston, Mass.—President, William A. Gaston; vice-president, William A. Bancroft; treasurer, William Hooper; secretary and clerk, John T. Barnett; directors: Frederick H. Ayer, of Lowell; Hon. William A. Bancroft, ex-Mayor of Cambridge; Samuel Carr, trustee of the Ames estate; T. Jefferson Coolidge of the Old Colony Trust Company; William Endicott, Jr., of the firm of C. F. Hovey & Co.; William A. Gaston; Gen. Charles J. Paine, one of the members of the International Monetary Commission; F. H. Peabody, senior member of the firm of Kidder, Peabody & Co.; James M. Prendergast, Jacob C. Rogers, banker, and Robert Winsor of Kidder, Peabody & Co.

Bristol County Gas & Electric Light Company, Bristol, Conn.—Directors: Marsden J. Perry, Leander Peck, Barrington; John S. Waterman, Benjamin M. Rosworth, Benjamin B. Martin, Warren; William T. C. Wardwell, William R. Bogert, J. H. Manchester and Samuel P. Colt, Bristol.

Brooklyn City Railroad Company, Brooklyn, N. Y.—Directors: E. H. K. Belcher, George W. Bergen, Eugene Britton, R. L. Edwards, S. L. Husted, Jr., David C. Legett, Frank Lyman, Edward Morrill, George H. Prentiss, Alonzo S. S. Simpson, F. A. Van Iderstine, Edward D. White.

Central Railway & Electric Company, New Britain, Conn.—President, A. M. Young; secretary and general manager, E. H. Mather; treasurer, F. G. Platt.

Chester Traction Company and its leased lines, Chester, Pa.—Chester Traction Company—President, George B. Lindsay; directors: George B. Lindsay, Robert Wetherill, Richard Wetherill, J. Frank Black, Henry C. Howard, Union Traction Company—President, George B. Lindsay; directors: Robert Wetherill, Richard Wetherill, J. Frank Black and Henry C. Howard. Chester Street Railway—President, J. Frank Black; directors: J. Frank Black, Robert Wetherill, Richard Wetherill, George B. Lindsay and George C. Hetzel. Chester, Darby & Philadelphia Railway Company—President, Richard Wetherill; directors: Richard Wetherill, Robert Wetherill, J. Frank Black, George B. Lindsay and George C. Hetzel. Chester & Media Railway Company—President, Richard Wetherill; directors: Richard Wetherill, Robert Wetherill, J. Frank Black, George B. Lindsay and George C. Hetzel.

Fairmount Park & Haddington Railway Company, Philadelphia.—President, Isaac Blum; directors: Simon J. Martin, George D. McCreary, Samuel Y. Heebner, J. Roberts Foulke and Martin V. Burton.

Hestonville, Mantua & Fairmount Passenger Railway Company, Philadelphia.—President, Isaac Blum; directors: Simon J. Martin, George D. McCreary, Samuel Y. Heebner, Ferdinand Marks and Lewis A. Riley.

Hollidaysburg Electric Light & Power Company, Hollidaysburg, Pa.—President, James W. Grounler; vice-president, W. H. Markland; secretary and treasurer, John W. Cliber; directors: W. H. Markland, James W. Grounler, John W. Goodfellow, O. M. Irvin and J. Lee Plummer.

Kings County Electric Light & Power Company, Brooklyn, N. Y.—President, Felix Campbell; vice-president, W. T. Wilson; secretary, S. E. Peck; directors: Seth L. Keenly, Hugh J. Grant, W. T. Wilson, Walter Ferguson, Charles Cooper, George E. Terry and C. L. Peck.

LaCrosse Brush Electric Light & Power Company, LaCrosse, Wis.—President, J. J. Hogan; secretary and treasurer, C. H. Greenwood; directors: J. J. Hogan, E. E. Bentley and James Vincent.

Lausburg & Cohoes Railroad Company, Lausburg, N. Y.—Directors: William Kemp, Otis G. Clark, Charles Clemmshaw, Charles H. Dauchy, Augustus A. Peebles, Edward Van Schoonhoven, Thomas Breslin, Charles H. Smith, C. G. Clemmshaw, J. J. Hagen and William Kemp, Jr.

New Orleans Traction Company, New Orleans, La.—President, R. M. Walmsley; vice-president, J. C. Davis; general manager, C. D. Wyman; secretary and treasurer, A. H. Ford; directors: R. M. Walmsley, C. H. Hyams, A. Baldwin, Sr., Frank T. Howard, J. C. Denis, C. D. Wyman and Geo. W. Norton.

Omaha Street Railway Company, Omaha, Neb.—President, Frank Murphy; vice-president, Guy C. Burton; treasurer, W. W. Marsh; secretary, D. H. Goodrich; general superintendent, F. A. Tucker; directors: Guy C. Burton, J. J. Brown, W. W. Marsh, S. D. Mercer, W. V. Morse, Frank Murphy, E. W. Nash, B. F. Smith (elected to fill the vacancy caused by the death of ex-Senator Paddock), and W. A. Smith.

Ringling Rocks Electric Railway Company, Pottstown, Pa.—President, M. R. Davidheiser; vice-president, T. B. Miller; secretary, Frank S. Brant; treasurer, A. K. Shaner; directors: M. R. Davidheiser, T. B. Miller, A. K. Shaner, F. S. Brant, R. E. Shaner, A. Hartenstine, W. H. Saylor, G. C. Hollenbach and H. G. Rohm.

Schuylkill Electric Railway Company, Pottsville, Pa.—President, C. P. King; directors: R. C. Luther, William F. North, F. H. Treat, W. Matthew Beddow, Thomas B. Prosser, H. H. Pearson, Jr., M. S. Collingwood.

Tanawqua & Pottsville Electric Railroad Company, Pottsville, Pa.—President, Thomas B. Prosser; directors: John F. Finney, C. P. King, F. H. Treat and W. Fallock, Jr.

Troy & Cohoes Railway Company, Troy, N. Y.—Directors: A. A. Peebles, O. G. Clark, William Kemp, Chas. Clemmshaw, C. W. Tillinghast, James A. Eddy, Peter Mc-

Carthy, Thomas Vail, Edward M. Green, C. G. Clemmshaw and J. J. Hagen.

Troy City Railway Company, Troy, N. Y.—Directors: William Kemp, Charles Clemmshaw, Otis G. Clark, Edward Murphy, Jr., Anthony N. Brady, James O. Neil, Peter McCarthy, Thomas Breslin, William Shaw, D. J. Whelan, Clarence N. Flack, Francis N. Mann, Jr., and Edgar L. Freeman.

COMMERCIAL PARAGRAPHS.

The Central Electric Company, 173-175 Adams street, Chicago, seem to be doing a brisk business in the lamp line. Any one desiring to procure brackets, shades or other lamp appurtenances would do well to write the Central Electric Company as they carry an immense variety of such fixings in stock. For a business man obliged to work at night their Kinsman Desk Light would seem all that could be desired.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

No-To-Bac For Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

At this season of the year the amount of iron line material that enters into the business of a large supply house is indeed surprising. The Electric Appliance Company, Chicago, state that they are carrying a stock of these goods that will enable them to make prompt shipments of anything up to a car load, and yet their capacity has been taxed on these goods. The iron mills throughout the country have had a large amount of business this season, and it has at times been very difficult to get iron line material. The Electric Appliance Company, however, anticipated this condition and during the season have been able to keep their stock in shape so that all orders for this material could be shipped promptly. They state that their stock is still being kept up and that customers wanting iron construction material promptly from Chicago stock will not be disappointed.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

In the use of transformers for electric lighting only a comparatively low voltage is introduced into buildings, and as long as this voltage is maintained the electric lighting is safe to human life; but often through faulty construction of the transformer, or failure of the insulation, the primary passes into the secondary wire—then the lighting becomes dangerous. That this does occur in spite of the most careful construction is proven by a number of deaths from this cause. To make electric lighting safe to human life, and to guard against fire, some protecting device must be used. A device of this nature which is everything that could be desired is one invented by Major Cardew and manufactured by the Diamond Electric Company, 1202 Fisher Building, Chicago. In this Earthing Device the action depends on electrostatic attraction between two plates of an aluminous foil; the latter is permanently kept at the potential of the earth while the upper plate under ordinary circumstances has a potential not exceeding the secondary voltage. The electrostatic attraction corresponding to this potential difference is insufficient to raise the foil. If, however, a fault occurs between the primary and secondary, the potential difference immediately rises to such an amount that the electrostatic attraction suffices to raise the foil and bring it into contact with the upper plate, thereby earthing the secondary winding and making the primary fuse go. The apparatus is set to come into action if the potential of the secondary rises to 400 volts. The Diamond Electric Company not only handles this well known device, of which there are 5,000 in use, but also manufactures Scheffler Transformers, which have a wide reputation, and high-grade electrical measuring instruments.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic, 10c or 25c. If C. C. C. fail to cure, druggists refund money.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

INCORPORATIONS.

The Middletown Gas & Electric Light Company, Middletown, O. Capital stock, \$50,000.

The Aladdin Light Company, Chicago—to manufacture electrical goods. Capital stock, \$100,000. Incorporators: Frank H. Fuller, Alonzo P. Daniel, Will am B. Reed.

The Electric Light Company of Manitowish, Wis., has filed a notice with the Secretary of State at Madison that it has increased its capital stock from \$50,000 to \$60,000.

The Ward Electric Light & Power Company, Denver, Col.—to operate and maintain an electric plant in Boulder. Capital stock, \$15,000. Incorporators: C. W. Betts, J. A. Kilton and A. W. Olsen.

Colp, Arnold & Co., Cartersville, Ill.—to operate flouring mill, electric light plant and general commission business. Capital stock, \$25,000. Incorporators: John Colp, H. F. Arnold, Monroe Colp and U. L. Walker.

Story Electric Company, Chicago—to do a general electrical business, furnish light, heat and power, and general manufacturing business. Capital stock, \$10,000. Incorporators: W. H. Ut, G. W. Oberlander and Eric Winters.

The Ellwood & New Castle Street Railway Company, Ellwood, Pa.—to operate a street railway running from Ellwood City to New Castle through the towns of Wampum, Newport, Moravia and Mahoningtown. Capital stock, \$80,000.

The Miami River & Belt Railway Company, Sidney, O.—to build and operate an electric railway. Capital stock, \$10,000. Incorporators: I. H. Thedwick, H. T. Mathers, Charles Timmons and Frank Hunter, of Sidney, and A. T. Wells, of Chicago.

The Carson Electric Light Company, Carson, Iowa—to construct and operate an electric light plant in Carson. Capital stock, \$5,000. Incorporators: John F. Reid, president; J. S. Campbell, secretary; D. A. Snapp, treasurer; William F. Hotz, manager.

The Huguenot Electric Street Railway Company of Westchester County, N. Y., New Rochelle—to construct and operate a railroad eleven miles long to run from the railway station in New Rochelle, making a circle through the back country and return to the station. Directors: M. R. Faulkner, John A. Cass and A. B. Linderman, of Philadelphia; Louis K. Fries, Jacob M. Schuyler, James H. Burchell and N. J. Burchell, of New Rochelle; Frank E. Wiggins, of Williamsbridge, and George C. Day, of New York City.

The Los Angeles-Pacific Railway Company, Los Angeles, Cal.—formed for the purpose of consolidating the property and franchises of the two corporations known as the Pasadena & Pacific Railway Company of Arizona and the Pasadena & Pacific Railway Company of California, and to construct and operate electric railway tracks from Los Angeles to Santa Monica, with branch lines running to Hollywood, Laurel canyon, South Santa Monica, Santa Monica canyon and Soldiers' Home, with an estimated length for the whole system of 100 miles. Capital stock, \$1,000,000, fully subscribed. Directors: E. P. Clark, Wm. D. Larrabee, Warren Gillelan, Milton E. Hammond, J. H. Spies, R. F. Jones, A. I. Smith, T. C. Paxton, J. M. Cope, M. H. Sherman, B. N. Pratt, W. C. Durgin and John D. Pope.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 4, 1898

ELECTRIC LIGHTS AND APPLIANCES.

596,782. Means for Varying Candle-Power of Incandescent Electric Lamps. Charles E. Felch, Natick, Mass., assignor of one-half to Oliver A. Felch and Walter L. Felch, same place. Filed June 21, 1897.

596,729. Support for Electric Lamps. Otis C. White, Worcester, Mass. Filed Feb. 16, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

596,515. Starting-Box for Electric Motors. John D. Hilder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Oct. 11, 1897.

596,567. Converter for Monophasic Currents. Andre Blondel and Gaston Sautter, Paris, France. Filed June 27, 1895.

596,923. Automatic Potential-Regulator for Dynamos. Allen A. Tirrill, Whitefield, and Paul S. Tirrill, Groveton, N. H. Filed May 1, 1897.

ELEVATOR APPARATUS.

596,513. Compound Brake for Electric Elevators. John D. Hilder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Sept. 14, 1896.

596,514. Safety Magnet-Brake. John D. Hilder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Sept. 21, 1896.

TELEPHONE AND TELEGRAPH APPARATUS.

596,496. Telephone. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, same place. Filed April 10, 1896.

596,709. Signaling Apparatus for Telephone Systems. Frank J. Holmes, Cleveland, O. Filed March 25, 1896.

596,601. Supervisory Signal for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Oct. 26, 1896.

596,610. Signaling System for Telephone Trunk-Lines. Frank R. McBerty, Downer's Grove, Ill., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 24, 1896.

596,625. Plug and Spring-Jack for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 29, 1895.

596,626. Spring-Jack for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 14, 1896.

596,627. Annunciator for Telephone-Lines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 14, 1895.

596,628. Supervisory Signal for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 16, 1896.

596,629. Testing Apparatus for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 8, 1896.

596,630. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 8, 1896.

TELEPHONE AND TELEGRAPH.

- 596,806. Apparatus for Telephones. Frank B. Cook, Chicago, Ill. Filed March 17, 1896.
 596,808. Telephone-Transmitter. David A. Fleming, Indiana, Pa., assignor to himself and McLain Davis, same place. Filed April 12, 1897.
 596,834. Telephone-Transmitter. James H. Spencer and Malcolm S. Keyes, New York City, assignors to the Spencer Electrical Company, same place. Filed Jan. 14, 1897.
 596,850. Telephone Switch-Plug. Frank B. Cook, Chicago, Ill. Filed Jan. 4, 1896.
 596,851. Telephone Apparatus. Frank B. Cook, Chicago, Ill. Original application filed Nov. 30, 1891. Divided and this application filed Oct. 23, 1895.
 596,852. Switch for Telephone-Circuits. Frank B. Cook, Chicago, Ill. Original application filed March 25, 1895. Divided and this application filed Dec. 1, 1896. Renewed Oct. 25, 1897.

MISCELLANEOUS.

- 596,483. Electric Fan. Oliver F. Conklin, Springfield, O. Filed June 17, 1897.
 596,506. Electric Switch. Warren S. Hill, Hyde Park, Mass., assignor to the W. S. Hill Electric Company, Boston, Mass. Filed May 1, 1896.
 596,612. Press for Making Insulators. Henry M. Brookfield, New York, and Seraphin Kribs, Brooklyn, N. Y., assignors to William Brookfield, New York City. Filed Jan. 2, 1897.
 596,682. Press for Making Insulators. Seraphin Kribs, Brooklyn, N. Y., assignor to William Brookfield, New York City. Filed Jan. 30, 1897.
 596,696. Electric Oven. Levitt E. Custer, Dayton, O. Filed March 16, 1896.
 596,719. Magnetic Ore-Separator. Lewis G. Rowand, Camden, N. J., assignor to the Wetherill Concentrating Company, New York City. Filed April 15, 1897.
 596,774. Electric Signaling Apparatus. Felix B. Herzog, New York City. Filed May 31, 1895.
 596,791. Voltaic Battery. Henri Etienne de Rutz de Lavi-sion, Nemilly-sur-Seine, France. Filed May 28, 1897.
 596,812. Subterranean Electric Conduit. William D. M. Howard, Redwood City, Cal. Filed June 18, 1897.
 596,907. Electric Cable for Propulsion of Vehicles. Addison Norman, Toronto, Canada. Filed July 8, 1896.
 596,926. Trolley-Guard. Herman J. Vogler and Alfredo Flores, San Antonio, Tex.; said Flores assignor to said Vogler. Filed Oct. 16, 1897.
 596,913. Electric Clock. Frederic Richard, Lynn, Mass., assignor of one-half to Theodore Leutz, Boston, Mass. Filed Aug. 21, 1896. Renewed Nov. 24, 1897.
 596,935. Automatic Temperature-Regulator. Addy A. Ross, Detroit, Mich., assignor of thirty-one forty-eighths to Almon C. Varney and Alvin W. Varney, same place. Filed March 31, 1897.

DESIGN.

- 28,124. Electric-Motor Casing. Andrew L. Riker, New York City. Filed Nov. 21, 1897. Term of patent 7 years.

ISSUED JANUARY 11, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 597,056. Electric-Railway Conduit System. Ralph F. Thompson, Alexandria, La., assignor of one-half to Edward Jeremiah Sullivan. Filed July 13, 1897.
 597,156. Electric-Railway Motor. Charles J. Van Depoele, Lynn, Mass.; C. A. Coffin and Albert Wahl, administrators of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed June 11, 1890.
 597,159. Automatic Tender for Trolley-Operating Ropes. Charles F. Wilson, Brooklyn, N. Y. Filed Oct. 1, 1896.
 597,202. Electric Railway. Hosea W. Libbey, Boston, Mass. Filed March 10, 1897.
 597,282. Trolley-Guard. Henry F. Hendricks and James H. Denton, Philadelphia, Pa., assignors to James H. Bates, Somerset, Ky. Filed Sept. 12, 1896.
 597,306. Current Collecting Means for Electric-Railway Vehicles. Charles A. Terry, New York City, assignor to the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Filed Sept. 7, 1896.
 597,374. Controller for Electric Cars. John C. Henry, Denver, Col. Filed Nov. 6, 1897.
 597,203. Car-Fender. John Megown, Youngstown, O., assignor of one-half to Edmond H. Moore, same place. Filed April 30, 1897.
 597,216. Car-Fender. Paul Jones, Cincinnati, O. Filed April 24, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 597,172. Filament for Incandescent Lamps. Erwin F. von Wilmowsky, Boston, Mass., assignor of one-half to Walter D. Edmonds, New York City. Filed Sept. 8, 1896.
 597,244. Combination Gas and Electric-Light Fixture. Joseph W. Parkin, Philadelphia, Pa. Filed Dec. 23, 1896.

ELECTRICAL MACHINERY AND APPARATUS.

- 597,018. Method of Regulating Speed of Series Electric Motors. Horace F. Marshall, London, England. Filed April 5, 1897.
 597,137. Static-Induction Electric Generator. Adrian L. Bogart, Jamaica, N. Y., assignor to William B. M. Jordan, New York City. Filed May 5, 1897.
 597,180. Electric Transformer. Jacob F. Gates, Pittsburgh, Pa. Filed Jan. 29, 1897.
 597,265. Controller for Electric Motors. Charles S. Cook, Pittsburgh, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed Jan. 2, 1897.
 597,033. Apparatus for Stating Time and Number of Telephone Conversations. Erich Kosanke, Carl Fuhrand Bruno Krause, Wilmersdorf, Germany, assignors to Heinrich Elchewede, Berlin, Ger. Filed July 5, 1895.
 597,032. Telephone-Exchange System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 22, 1897.
 597,032. Calling Device for Telephone-Exchanges. Alexander E. Keith, John Erikson and Charles J. Erikson, Chicago, Ill., assignors to the Strowger Automatic Telephone Exchange of Illinois. Filed Aug. 20, 1896.

MISCELLANEOUS.

- 597,012. Graphite Rheostat. Edward W. Jewell, Chicago, Ill. Filed May 8, 1897.
 597,110. Insulating Trolley-Hanger. Edward J. Cook, Cleveland, O. Filed Dec. 2, 1897.
 597,224. Adjustable Switchboard. Henry H. Walker and Frank D. Walker, Philadelphia, Pa. Filed Sept. 23, 1897.
 597,573. Electric Searing Pen. Henry Green, Hartford, Conn. Filed April 15, 1897.

A New Telephone Company in New Orleans.

The People's Telephone Company has been chartered under the laws of Louisiana with domicile in New Orleans. It is backed by New York, Detroit and Louisville capital and will, it is understood, use the same system as that now in successful operation by the independent company at Detroit. The capital stock of the company is put at \$600,000, and it will charge \$36 to \$42 per instrument, or about one-third less than the charges of the Great Southern Telephone & Telegraph Co., which has at present a monopoly of the telephone business in New Orleans. The *Times-Democrat* states that "the plans of the new company have been in hand for more than four months, and various Northern cities where this system has been in successful operation for many years have been visited and much valuable information secured; and having the necessary money behind them, the members of the new company are ready to begin business as soon as permission is secured from the city council to put its wires underground in accordance with the recent ordinance." The charter officers are as follows: George N. Norton, president; William P. Curtis, vice-president, with a secretary and treasurer to be elected at the first meeting of the board of directors, which is composed as follows: George N. Norton, Franklin Everhart, J. M. Billups, Jr., Brainard Rorison, George A. Beaton, William P. Curtis, S. P. Walmsley, A. T. Moss and Frank P. Mullen. Messrs. Norton, Everhart and Billups are New York capitalists. Mr. Rorison has been in New Orleans for many years as manager of the Barber Asphalt Company, and has also been interested in the drainage company. Mr. Beaton is a Detroit capitalist, and will be general manager of the new concern. Messrs. Walmsley and Moss are well known among New Orleans business men. Mr. Mullen has been resident general manager of the Barber Asphalt Company for some time.

The *Times-Democrat* was informed by one of the officers of the company that already subscriptions for the new telephones were coming in rapidly and the members of the company had every reason to expect success.

The fight which has been waged in New York city against the New York Telephone Company by its subscribers for lower rates equivalent to those charged for like service in other large cities in this country and Europe is to be continued. A bill for a \$125, instead of the present \$240 rate, and with the provisions of the Brush bill of last winter, is being prepared by the Board of Trade and Transportation Committee on Telephone Legislation, and it will be offered in the State Senate at an early day. Simon Sterne, who has been energetically urging action against the telephone company to establish the legal status of the corporation and its subscribers for the benefit of all interested, is looked upon as the leader in the fight, and he is as determined as ever.

The Spottswood Telephone Company, who are the owners of the line between Lexington and Staunton, Va., are making extensive improvements on their system. A switchboard will be put in at Raphine, midway between Staunton and Lexington, and a third wire put up for commercial business, and thus remove much of the annoyance now experienced by interruption to communication between the two places. This company is now extending its present system to other points in Augusta and Rockbridge counties. A nine-mile line from Raphine to Zack and a branch line to Brownsburg are in process of erection, and work is also progressing on the line from Raphine to Moffett's Creek and vicinity.

The first thing the Delmarvia Telephone Company did when it started into business in Wilmington, Del., where it has secured 800 subscribers, was to make a big reduction in the price of telephones, placing one in a private residence for \$24 a year and one in a business place for \$36 a year. The old company (Delaware & Atlantic Telephone & Telegraph Co.) had been charging from \$40 to \$90, but now announces that it will give a liberal rebate on all bills. This rebate is so great that the 'phones of the old company can be secured for the same price as those of the Delmarvia. The fight has resulted in many persons subscribing to both companies. The service is so cheap that clerks, small shopkeepers, cigar dealers and barbers are ordering 'phones placed in their homes and places of business.

The Augusta (Ga.) Telephone & Electric Company at its annual meeting on the 5th inst., elected these officers: President, Paul P. Verdery; secretary, P. S. North; manager, Paul Langdon; superintendent, Lee Campbell. The company uses the Strowger 'phone and has 436 instruments in operation in Augusta. The *Chronicle* says the company has met with wonderful success and is a home enterprise that the people are proud of.

Mr. Keezel has introduced in the Virginia House a bill to incorporate the Rockingham Mutual Telephone & Telegraph Company.

Another Successful Independent Telephone Exchange.

The Corry Telephone Exchange, Corry, Pa., is a bright and prosperous example of what pluck, perseverance and enterprise can do when joined to expert knowledge of the matter in hand. It has been successful from the beginning, and although the system is a comparatively small one, the exchange has been conducted with such skill and economy as to make it a paying concern. The exchange was started about two years ago by A. S. Keating, who for years had been engaged in experimental electrical work, and had already secured several valuable patents on electrical appliances connected with telegraph, telephone, arc light and dynamo construction. Mr. Keating conceived the idea of putting in a popular priced telephone system in Corry, manufacturing the 'phones himself, and the results have justified his enterprise. He had the opposition of the Bell company to contend against, but this did not deter him from going ahead, and his exchange has now so far distanced that of the Bell that it is recognized by all as the only real telephone exchange for local purposes in Corry. The telephone used by the company is the Keating telephone, which is not only a handsome instrument but a thoroughly efficient one, giving entire satisfaction. The rates charged by the company are \$24 per year for business and \$18 for residences. The officers of the Corry Telephone Exchange are: E. L. Keating, proprietor; A. S. Keating, general manager, and L. K. Keating, the manager's son, electrician.

The *Chattanooga Times* says: "There is a movement on foot to establish a new telephone company in this city, and in all probability the city council will be asked for a franchise at its next regular meeting. It is understood that several well-known citizens are financially interested in the scheme and that they will lend their influence to secure the franchise from the city council. In conversation with a *Times* man yesterday one of the 'interested' gentlemen stated positively that a new company is now being organized and that the promoters would make the city a liberal offer for a franchise."

An independent telephone company is being formed at Danville, N. Y., for the purpose of giving the citizens of the town the use of the telephone at much lower rates than those of the Bell company now in operation there. The new organization will be similar to the recently formed Business Men's Telephone Company of Nunda and connections by wire will be made with that and other towns of the county as soon after construction of the Danville line as practicable.

J. B. Norris, the veteran telegrapher, who has for years been the chief night operator at the Chattanooga office of the Western Union, has been appointed manager of that office to succeed the late E. C. Dunn. Mr. Norris learned the art of telegraphy in the fifties, and during the war he was in the field in Grant's command with Gen. Thomas Eckert, now president of the Western Union Company. He has been connected with the Chattanooga office twenty-five years and has always enjoyed not only the confidence and esteem of the employees of the office, but of the entire business community.

Long distance telephone connection has just been completed from Watertown to Ogdensburg, Canton and Potsdam, N. Y., taking in all stations north of Jefferson and St. Lawrence counties. The Central New York Company has spared no expense in erecting the new lines, and everything is of the very best material and workmanship. The towns and villages in Northern New York are now in communication with Utica, Syracuse, Rochester, Buffalo, Albany, New York and all long-distance points.

The Railway Commissioners of North Carolina have made a sweeping reduction in yearly telephone rates of rental to go into effect February 1. On and after that date the rates are to be as follows: Business telephones, special wire, \$30; two and three party wire, each, \$24; four and five party wire, each, \$18. Residence telephones—special wire, \$18; two and three party wire, each, \$16; four and five party wire, each, \$14. These rates do not apply to service outside the corporate limits of any city or town.

The North Carolina Railroad Commission still has under consideration the advisability of withdrawing the case of the Western Union Telegraph Company, relative to a reduction of telegraph rates, from the United States Court. This, the counsel for the telegraph company states, is the reason they wanted additional time in which to file the pleadings in reply to the answer of the commission.

The Western Union Telegraph Company has completed its connections with the Mexican lines that have recently come into its possession, and messages can now be sent direct into the heart of Mexico from New York. The total length of the circuit is about 4,000 miles.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Jan. 17:							Hartford Conn.—Jan. 17:						
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1 1/2 % Q., Aug. '97.	134	135	Hartford Street Ry. Co.....	100	\$2,000,000	\$200,000	3 % S., July, '97.	189	..
Troy City Railway Co.....	100	2,000,000	2,000,000	1 1/2 % Q., Sept. 10, '97.	70	72	Hartford & West Hartford RR.....	100	1,000,000	247,000	.....	..	..
Traction Co. (Saratoga).....	100	50,000	50,000	.....	..	..	Holyoke Mass.—Jan. 17:						
Allentown, Pa.—Jan. 17:							Holyoke Street Ry. Co.....	100	400,000	400,000	4 % A., July, '97.	203	203
Allentown & Lehigh Val. Trac. Co.....	....	4,000,000	1,500,000	.....	..	80	Hoboken, N. J.—Jan. 17:						
Bridgeport, Conn.—Jan. 17:							North Hudson Co. (N. J.) Ry. Co.....	25	1,250,000	1,000,000	8 % 1892.	70	..
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	Indianapolis, Ind.—Jan. 17:						
Baltimore, Md.—Jan. 17:							Citizens' Passenger Ry.....	....	5,000,000	5,000,000	.....	20	22
Baltimore City Passenger Ry. Co.....	25	6,000,000	2,500,000	5 % S., July 2, '97.	56 1/2	66 1/2	Lancaster, Pa.—Jan. 17:						
Baltimore Traction Co.....	25	10,000,000	5,750,000	1 1/2 % Q., Jan., '97.	20	20 1/2	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	..	..
Central Ry. Co. of Baltimore City.....	50	800,000	800,000	6 % A., 1897.	80	..	Lancaster & Col. Electric Ry.....	....	..	87,500	.....	..	..
Cty & Suburban Ry. Co.....	50	4,000,000	4,000,000	2 % A., Jan., '97.	48	..	West End Street Railway.....	....	..	..	.....	..	..
Boston, Mass.—Jan. 17:							Louisville, Ky.—Jan. 17:						
New England Street Ry.....	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..	Louisville Ry.....	100	4,000,000	4,000,000	1 1/2 % A., '97.	10	41
North Shore Traction Co.....	100	4,000,000	4,000,000	3 % S., Oct. '96.	12	15	Louisville Ry.....	100	2,000,000	2,000,000	2 1/2 % S., Apr. 1, '97.	94	96
North Shore Traction Co.....	100	2,000,000	2,000,000	6 % S. A. & O.	73	75	Minneapolis, Minn.—Jan. 17:						
West End Street Ry. Co.....	50	10,000,000	9,045,000	4 % S., Oct., '97.	83 1/2	84	Twinn City Rapid Transit.....	100	17,000,000	15,010,000	.....	15	20
West End Street Ry. Co.....	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	103	104	Twinn City Rapid Transit.....	....	8,000,000	1,137,200	1 1/2 % A., '97.	..	100
Brooklyn, N. Y.—Jan. 17:							Montreal, Canada.—Jan. 17:						
Brooklyn City & Newtown Ry.....	100	2,000,000	1,000,000	2 1/2 % Aug. 1, 1897.	178	180	Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8 % S., M. & N.	241	243
Brooklyn Rap. Transit Co., tr. certf.....	100	20,000,000	20,000,000	4 1/2 %	40 1/2	40 1/2	Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	94	94 1/2
Brooklyn Heights Railroad.....	....	200,000	200,000	.....	..	..	Memphis, Tenn.—Jan. 17:						
Brooklyn City RR.....	100	12,000,000	12,000,000	2 1/2 % Q., July, '97.	20 1/2	204	Citizens' Street Railway Co.....	100	1,500,000	1,500,000	.....	15	..
Brooklyn, Queens Co. & Sub. RR.....	....	2,000,000	2,000,000	.....	..	..	New Haven, Conn.—Jan. 17:						
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1 1/2 % July 1, '97.	150	180	Fair Haven & Westville RR.....	25	1,500,000	900,000	1 % S., Sept. '96.	57	60
Kings County Elevated.....	....	4,750,000	4,750,000	.....	..	..	New Haven Street Railway Co.....	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60	80
Kings County Traction Co.....	100	4,500,000	4,500,000	1 1/2 % July 26, '97	47	48	New Haven & Centerville.....	100	700,000	800,000	.....	..	..
Nassau Electric Railroad.....	....	6,000,000	6,000,000	.....	..	..	Winchester Avenue RR.....	25	1,000,000	600,000	.....	40	42
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	..	..	New Orleans, La.—Jan. 10:						
Brooklyn, B. & W. E. Railroad.....	....	1,000,000	1,000,000	.....	74	80	Canal & Claiborne RR. Co.....	40	240,000	240,000	2 1/2 % S., July, '95.	140	150
Buffalo, N. Y.—Jan. 17:							New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	1 1/2 % Q., Apr., '97.	123	125 1/2
Buffalo & Niagara Falls Elec. Ry.....	100	1,250,000	1,250,000	.....	56	58	New Orleans Traction Co.....	100	5,000,000	5,000,000	.....	3	6
Buffalo Railway Co.....	100	6,000,000	5,870,500	1 % Q., Sept., '97.	78	80	New Orleans Traction Co.....	100	2,500,000	2,500,000	6 % S., J. & J.	..	30
Columbus O.—Jan. 17:							Crescent City RR.....	100	2,000,000	2,000,000	3 % S., July, '97.	..	62
Columbus Street Railroad.....	100	3,000,000	3,000,000	1 % Q., Feb., '97.	43	46	New Or. City & Lake RR.....	100	2,000,000	2,000,000	4 % S., July, '97.	105	110
Columbus Central Street Railroad.....	100	1,500,000	1,500,000	.....	..	..	Orleans Railroad.....	50	500,000	185,000	1 1/2 % S., June, '94.	10 1/2	14
Charleston, S. C.—Jan. 17:							St. Charles Street Railway.....	50	1,000,000	1,000,000	1 1/2 % A., '97.	55	56
Charleston City Ry. Co.....	50	100,000	100,000	3 % S., Jan., '97.	..	..	New York—Jan. 17:						
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	..	..	Central Crostown RR.....	100	600,000	600,000	2 1/2 % Q., July, '97.	199	200
Chicago, Ill.—Jan. 17:							Christopher & 10th St. RR. guar.....	100	650,000	650,000	2 % Q., Apr., '97.	155	165
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3 % Q., Sept. 15, '97.	235	237 1/2	Dry Dock, E. Bldg. & Battery RR.....	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '97.	..	190
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800	.....	..	..	Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1 1/2 % Q., July, '97.	130 1/2	140
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	17	17 1/2	Bleecker St. & Fulton Pk. Ry. guar.....	100	900,000	900,000	4 % A., July, '97.	30	83
Metropolitan West Side Elev. Ry.....	100	15,000,000	15,000,000	.....	4 1/2	5	Broadway & Seventh Ave. guar.....	100	2,100,000	2,100,000	2 1/2 % Q., July, '97.	205	206
Met. West Side El. const. stk.....	100	15,000,000	2,500,000	.....	..	..	Cen. Park N. & E. Rivers RR. guar.....	100	1,800,000	1,800,000	2 % Q., July, '97.	170	..
North Chicago Street RR.....	100	10,000,000	6,600,000	8 % Q., Oct., '97.	223	225	Eighth Avenue RR.....	100	1,000,000	1,000,000	.....	320	..
North Chicago City RR.....	100	500,000	249,900	.....	..	..	Ninth Avenue RR.....	100	750,000	748,000	4 % Q., Aug., '97.	325	340
South Chicago City Railway.....	100	2,000,000	1,603,200	.....	..	..	Sixth Avenue RR.....	100	2,000,000	2,000,000	.....	180	190
West Chicago St. RR. Co.....	100	20,000,000	13,189,000	1 1/2 % Q., May, '97.	101	101 1/2	Seventh Avenue RR.....	100	2,000,000	2,000,000	.....	192	195
Chicago West Div. Ry.....	100	1,250,000	621,900	35 %	..	..	Twenty-third St. R. R. Co. guar.....	100	600,000	600,000	4 1/2 % Q., Aug., '97.	300	325
Chicago Passenger Ry.....	100	2,000,000	2,000,000	5 % S.	..	..	Third Avenue RR.....	100	2,500,000	1,862,000	1 1/2 % Q., Jan., '97.	130	..
Cincinnati, Ohio.—Jan. 17:							Mid 2d St. Manhattan & St. Nich. Av.....	100	2,500,000	2,500,000	2 % Q., Aug., '97.	176	178
Cincinnati Inc. Plane Ry.....	50	1,000,000	575,000	.....	..	20	Union (Huck)berry Ry.....	100	2,000,000	2,000,000	.....	100	108
Cincinnati Inc. Plane Ry.....	50	150,000	150,000	2 1/2 % S., Feb., '98.	..	75	Newark N. J.—Jan. 17:						
Cincinnati, Newport & Cov. St. Ry.....	100	4,000,000	3,500,000	.....	23	25	Consolidated Traction Co. of N. J.....	100	15,000,000	15,000,000	.....	48	48 1/2
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1 1/2 % Q., July, '97.	115	115 1/2	Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	..	..
Mt. Adams & Eden Park Inc. Ry.....	50	2,500,000	2,200,000	1 1/2 % Q., Oct., '96.	..	..	Rapid Transit Street Ry.....	100	504,000	504,000	1 1/2 % A.	180	185
Cleveland, Ohio.—Jan. 17:							Pittsburg, Pa.—Jan. 17:						
Armn. Bed. & Elec. Elec. Ry.....	100	1,000,000	1,000,000	.....	40	42	Allegheny Traction Co.....	50	500,000	500,000	.....	42	45
Cleveland City Ry.....	100	8,000,000	7,600,000	3 % S., Oct., '97.	60	61	Consolidated Traction Co.....	50	15,000,000	15,000,000	2 % Jan., '95.	11	11 1/2
Cleveland Electric Ry.....	100	12,000,000	12,000,000	3 % Q., Oct., '97.	52 1/2	53 1/2	Consolidated Traction Co.....	50	15,000,000	15,000,000	3 % May, '97.	43 1/2	44
Detroit, Mich.—Jan. 17:							Central Traction Co.....	50	1,500,000	1,500,000	.....	..	..
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	.....	..	..	Citizens' Traction Co.....	50	8,000,000	13,000,000	6 % A.	60 1/2	61
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000	5 % July, '96.	175	..	Duquesne Traction Co.....	50	8,000,000	13,000,000	.....	..	..
Rapid Railway Co.....	....	250,000	250,000	.....	..	100	Federal St. & Pleasant Valley Ry.....	25	1,400,000	1,400,000	2 % Aug., '95.	..	..
Detroit Electric Railway.....	....	1,000,000	1,000,000	.....	..	..	Pgh., Allegheny & Man. Trac. Co.....	50	8,000,000	12,964,830	2 % July, '97.	..	..
Wyandotte & Detroit River Ry.....	100	250,000	200,000	.....	100	110	Pittsburg & Birmingham Trac. Ry.....	25	3,000,000	3,000,000	1 1/2 % Aug., '95.	..	..
Dayton O.—Jan. 17:							Pittsburg & West End Ry.....	50	1,500,000	1,500,000	8 % A., June 30, '96.	..	18
City Railway Co.....	100	1,500,000	1,470,600	1 1/2 % Q., Oct. 1, '96.	88	100	Second Avenue Traction Co.....	50	4,000,000	14,000,000	.....	..	..
City Railway Co.....	100	600,000	600,000	1 1/2 % Q., Oct. 1, '96.	140	145	Suburban Rapid Transit Co.....	50	800,000	200,000	A.	..	..
People's Street Railway.....	....	1,100,000	..	.....	88	90							

* Unlisted.

b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.

i \$20,100 of stock owned by North Chicago Street Railroad Company.

j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

k 1 1/2 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$25,100 of stock owned by West Chicago Street Railroad Company.

l Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Railway for 99 years from Jan. 1, 1896, at \$215,000 per annum.

i Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

j Leased to Metropolitan Street Railway for 18 percent on capital stock.

k Leased to Metropolitan Street Railway for 18 percent on capital stock.

l Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.

m Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.

n Leased to Consolidated Traction Company for 8 % per

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—Jan. 17:							Boston, Mass.—Jan. 17:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2% Q., Oct., '97	269 1/2	270
Northampton, Mass.—Jan. 17:							Erie Telegraph & Telephone Co.....	100	...	...	1 1/2% Q., Aug., '97.	71	72
Northampton Street Ry.....	100	800,000	225,000	5% A., July, '97.	165	170	New England Telephone Co.....	...	10,894,600	10,804,600	\$1.25 sh. Q.	130	...
Omaha, Neb.—Jan. 10:							New York.—Jan. 17:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2% Q.	90	92
Paterson, N. J.—Jan. 17:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1 1/2% Q.	104	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	83	85	*Commercial Cable Co.....	100	10,000,000	10,000,000	1 1/2% Q.	180	180 1/2
Providence, R. I.—Jan. 17:							Franklin Tel. Co.....	100	1,000,000	1,000,000	2 1/2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	55	56	Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 1/2% Q., Aug., '97.	71	72
Philadelphia.—Jan. 17:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	5,000,000	1 1/2% Q.	107 1/2	110
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	2,000,000	.....	14 1/2	...	*International Ocean Tel. Co. guar. 6%	100	8,000,000	8,000,000	1 1/2% Q.	107	...
Hestonville, Man. & Fairmount.....	50	1,965,100	1,965,100	2 1/2% July 15, '97.	...	45	Mexican Telephone Co.....	100	2,000,000	2,000,000	1 1/2% Q.	50	50
Hestonville, Man. & Fairmount 6% pd.	50	585,900	585,900	3% S.—July 15, '97.	...	50 1/2	*New York & New Jersey Tel. Co.	100	5,000,000	3,728,000	1 1/2% Q., July, '97.	150	151
*Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '97.	60	...	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	2,000,000	2% S.	70	76
Union Traction Co. \$12 1/2 pd.	50	30,000,000	5,985,095	.....	14	14 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 1/2% Q.	99	101
Electric Traction Co.....	50	8,297,920	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5%	25	960,000	559,525	2 1/2% S.	99	95
*Citizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	285	290	*Commercial Union Telegraph Co...	25	500,000	500,000	5% S., July 1 '97.	117	...
*Frankford & Southwark Pass. Ry.	50	1,000,000	1,000,000	\$14 share A.—Apr. 97	370	...	Western Union Telegraph Co.....	...	97,870,000	97,870,000	1 1/2% Q., Oct., '97.	90 1/2	91
*Lehigh Avenue Ry. Co.....	25	1,000,000	1,000,000	A. & O.	40	...	Miscellaneous.—Jan. 17:						
*Lombard & South Street Ry....	25	1,000,000	1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000	400,000	.....	14	...
*Second & Third Streets Ry....	50	1,000,000	771,075	\$9 share A., Mar. 97	245	...	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	174	175
*People's Traction Co.....	50	10,000,000	1,600,000	3% A., April, '97.	...	...	Chesapeake & Potomac Tel. Co....	100	...	...	.....	67	69
*Germanstown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1897.	181	...	Chicago Telephone Co.....	100	...	...	.....	200	202
*Green & Coates Passenger Ry....	50	500,000	150,000	3% July, 1897.	135	...	Central Dist. Prtg. & Tel. Co. (Phg.)	100	750,000	750,000	.....	...	...
*People's Passenger Ry.....	25	1,500,000	740,000	.....	87 1/2	...	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1 1/2% Q.	12	78
*People's Passenger Ry. pfd.	25	750,000	277,402	.....	65	...	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1 1/2% Q.	64	66
*Philadelphia Traction Co.....	50	30,000,000	120,000,000	4% S.—Apr. 1, '97.	80	81	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2% Q.	110	115
*Catherine & Bainbridge St.....	50	1,000,000	400,000	6% A.—Mar. '97.	...	...	Providence (R. I.) Teleph. Co.....	50	...	...	.....	85	...
*Continental Pass. Ry. guar.	50	1,000,000	580,000	\$6 share—July, '97.	...	140	Southern New Eng. Teleph. Co....	100	8,000,000	8,000,000	.....	120	122
*Empire Passenger Ry. Co.....	50	600,000	600,000	.....	...	...				
*Philadelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180							
*Philadelphia & Gray's Ry. RR.	50	1,000,000	298,650	\$8.50 share July '97	87	...							
*Ridge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share, July '97.	2 2	...							
*Philadelphia & Darby Ry. guar.	50	...	200,000	\$2 share July, '97.	...	...					
*17th & 19th Sts. Pass. Ry. guar.	50	...	250,000	1 1/2% S., July, '97.	157 1/2	...							
*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	835,000	\$11 sh. A., July, '97	262	...							
*Union Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. July '97	226	...							
*West Philadelphia Pass. Ry.....	50	750,000	750,000	\$10 share, July '97	225	235							
Rochester, N. Y.—Jan. 17:							Boston, Mass.—Jan. 17:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	17	20	Fort Wayne Electric Co.....	25	...	...	.....	...	...
Reading, Pa.—Jan. 17:							Ft. Wayne Elec. Co. T. Sec. Series A.	25	...	...	.....	...	...
*Reading Traction Co.....	...	1,000,000	1,000,000	Semi-an. Jan. & Jy	10	15	General Electric Co.....	100	40,000,000	80,460,000	2 1/2% Q., Aug., 1898.	85 1/2	86
*City Passenger Ry.....	50	850,000	850,000	July, '97.	111	...	General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	89	90
*East Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	60	...	T. H. Elec. Co. T. Secur. Series D.	50	...	146,700	.....	24	25
St. Louis Mo.—Jan. 17:							Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	3,998,058	1 1/2% Q., Oct., '97.	54 1/2	55
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...	Westinghouse El. & Mfg. Co. pfd.	50	11,000,000	8,195,126	.....	...	...
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1888.	...	...	New York.—Jan. 17:						
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% July, '97.	124	126	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	127	130
National Railway Co.....	...	2,500,000	2,479,000	1 1/2% July, '97.	...	...	*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2% Q., Oct., '97.	105	106
Cass Avenue & Fair Grounds.....	...	2,500,000	2,500,000	.....	...	...	Edison Ore Milling Co.....	100	...	...	.....	...	...
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110	Edison Electric Storage Co.....	100	...	...	.....	...	...
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% July, '97.	95	105	General Electric Co.....	100	40,000,000	80,460,000	2 1/2% Q., Aug., 1898.	85 1/2	86
Missouri RR.....	50	2,400,000	2,800,000	1 1/2% July, '97.	170	172 1/2	General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	89	90
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	...	...	Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	...
Southern Electric Ry.....	50	500,000	500,000	.....	60	52 1/2	United Elec. Lt. & Pow. Co.	100	...	...	.....	...	...
Southern Electric Ry..... 6% pref.	100	1,000,000	1,000,000	3% S., Jan., '96.	100	102 1/2							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	53 1/2	5 1/2							
Union Depot RR.....	100	4,000,000	4,000,000	8% A., July, '96.	...	175							
San Francisco Cal.—Jan.							Pittsburg, Pa.—Jan. 17:						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	108 1/2	109 1/2	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	...
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	East End Electric Light Co.....	50	800,000	800,000	Q	...	10
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	52 1/2	Philadelphia, Pa.—Jan. 17:						
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	6	8	Edison Electric Light Co.....	100	2,000,000	2,000,000	.....	144 1/2	...
Scranton, Pa.—Jan. 17:							*Electric Storage Battery Co. com.	100	8,500,000	8,500,000	.....	26 1/2	...
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	7 1/2	10	*Electric Storage Battery Co. pfd.	100	5,000,000	5,000,000	.....	28 1/2	80
mScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	15	...	*Penna. Ht. Lt. & Pow. Co. com.	50	5,000,000	5,000,000	50c. p. sh., Oct. '97.	20 1/2	20 1/2
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11	*Penna. Ht. Lt. & Pow. Co. pfd.	50	5,000,000	5,000,000	6% Oct., '97.	45	45 1/2
Springfield Ill.—Jan. 17:							*Penna. Ht. Lt. & Pow. Co. pfd.	50	5,000,000	5,000,000	50c. p. sh., Oct. '97.	20 1/2	20 1/2
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11	Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	1,200,000	2 1/2% Q., Oct., '96.	82	83
Springfield O.—Jan. 17:							Rhode Island Elec. Protec. Co.....	100	...	...	.....	114	118
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2	Royal Elec. Co. (Montreal).....	100	1,000,000	1,000,000	2% Q.	142 1/2	148
Springfield, Mass.—Jan. 17:							Toronto (Canada) Elec. Light Co....	100	1,085,000	1,085,000	1 1/2% Q.	135 1/2	136
Springfield Street Ry.....	100	1,200,000	1,000,000	3% A.	205	210	Thomson-Houston Welding Co.....	100	...	...	3% S., Dec. 1, '96.	90	100
Toronto Canada.—Jan. 17:							Woonsocket (R. I.) Electric Co.....	100	...	...	.....	...	ex d.
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	94	94 1/2							
Montreal Street Railway Co.....	...	4,000,000	4,000,000	4% S.	211	248							
Washington, D. C.—Jan. 17:							Allied Industries.						
Belt Ry. Co.....	50	500,000	500,000	.....	...	...	Boston Mass.—Jan. 17:						
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	61	62	American Electric Heating Co.....	50	10,000,000	10,000,000	.....	...	...
Columbia Ry. Co.....	50	400,000	400,000	5 1/2% A.	63	64	Street Ry. & Illu'g Properties... pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	...	...
Eckington & Soldiers' Home Ry....	50	707,000	652,000	.....	...	...	United Electric Securities Co. pfd.	100	...	...	2 1/2% S., Feb., '96.	80	85
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	...	...	New York.—Jan. 17:						
Metropolitan R.R. Co.....	50	1,000,000	487,180	2 1/2% Q.	120	...	Consolidated Electric Storage Co..	...	...	...	.....	...	...
Worcester, Mass.—Jan. 17:							Edison European.....	...	...	...	.....	...	...
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	16 1/2	18	Safety Car Heating & Lighting Co..	100	...	...	.....	88	88
*Worcester Traction Co..... 6% pfd.	100	2,000,000	2,000,000	3% S., Sept., '97.	95	97	Worthington Pump Co.....	100	5,500,000	5,500,000	.....	28	...
Worcester & Suburban Street Ry...	100	550,000	642,500	4%, 1896.	85	...	Worthington Pump Co..... pfd	100	2,000,000	2,000,000	7%	60	85
Wilkesbarre, Pa.—Jan. 17:							Philadelphia, Pa.—Jan. 17:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29	Acetylene L. H. & P. Co.....	50	1,000,000	1,000,000	.....	5	...

BONDS.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Jan. 17 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	J. & J.	110%	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	M. & N.	110½	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	110	110½
Waterfront Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	117	.....
Waterfront Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	114½	.....
Troy City Railway Co. 1st 5s.	.....	.....	.....	.....	105¾	106¾
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.

Date of Quotation—Jan. 17, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	.....
Baltimore Trac. Co. Ext'n. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	104	105
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	115	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	111	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	111½	.....
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	114½	114½
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	108½	109
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	116	.....
151,000 in escrow to retire 1st mtg. bds.						

Boston, Mass.

Date of Quotation—Jan. 17, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	161½	105
West End Street Ry. Deben. g. 5s.	3,300,000	3,000,000	1902	M. & N.	105	107
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
161,674,000 in escrow to retire outstanding bonds of absorbed companies.						

Charleston, S. C.

Date of Quotation—Jan. 17, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.						

Chicago Ill.

Date of Quotation—Jan. 17, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102½	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 2d mtg. g. 5s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	103	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	55	52
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	.....
North Chicago St. RR. 1st mtg. 6s.	3,171,000	3,171,000	1906	J. & J.	101	101½
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	103½
North Chicago St. RR. 2d mtg. 6s.	500,000	500,000	1900	J. & J.	102½	.....
North Chicago City Ry. 1st mtg. 6s.	2,500,000	2,500,000	1927	M. & N.	102½	105
North Chicago City Ry. Consol. 4½s.	4,100,000	3,969,000	1928	M. & N.	101½	101½
West Chicago St. RR. 1st mtg. 6s.	2,700,000	700,000	1911	J. & D.	101	101½
West Chicago St. RR. Deben. 6s.	12,500,000	6,000,000	1936	.....	98	99
West Chicago St. RR. Cons. mtg. g. 5s.	1,500,000	1,500,000	1909	F. & A.	101	101½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	.....	.....	.....	.....	.....	.....
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chl. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.						

Cincinnati, O.

Date of Quotation—Jan. 17, 1898.						
Old New & Cov. St. Ry. 1st Con. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99½	100½
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 2d mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cln. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cln. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126	130
Assumed by the Cincin. St. Ry. Co. 1250,000 reserved to retire 1st mtg. bds.						

Cleveland, O.

Date of Quotation—Jan. 17, 1898.						
Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1908	M. & S.	105	106
Cln. New & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99½	100½
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	109	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	106½	107½
East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	90	95
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1915	J. & J.	100	102
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....
1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.						

Detroit, Mich.

Date of Quotation—Jan. 17, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	.....	95
Pt. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	98½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	.....	.....
115,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						

New Haven, Conn.

Date of Quotation—Jan. 17, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	102½	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	102½	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	102	.....
With interest.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—Jan. 10, 1898.						
Canal & Claiborne RR.....1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	100½	.....
Crescent City RR.....1st mtg. 6s.	.....	50,000	1899	M. & N.	100½	.....
Crescent City RR.....Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	78¾	80
New Orleans City RR.....1st mtg. 6s.	416,500	399,000	1908	J. & D.	106	109
N. Ori's City & Lake RR...1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¾	101½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	108	.....
Orleans Railroad Co.....Cons. mtg. 6s.	800,000	390,000	1912	J. & J.	91½	99
St. Charles St. RR. Co.....1st mtg. 6s.	800,000	75,000	1906	J. & D.	103½	.....
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
\$890,000 outstanding.						

New York.

Date of Quotation—Jan. 17, 1898.						
Atlantic Ave. (Brooklyn).... Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106½	*108
Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	101½	.....
Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	108
Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	109	112
Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	116	.....
Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	115
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114½	115
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	75	75½
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	100	103
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	104½	106
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	.....	80
Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	95	.....
Bleecker St. & Fult'n Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	106	108½
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	118	115
Central Crostown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	105	105½
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	*103
Eighth Av. RR. Co. Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	100	.....
42d St. Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	118
42d St. Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & S.	90	.....
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	.....
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1997	F. & A.	113½	113½
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	109
Second Avenue Ry. Deb. 5s.	800,000	800,000	1909	J. & J.	106	105
Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	112	115
South Ferry RR. Co. 1st mtg. 5s.	850,000	850,000	1919	.....	102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
Westchester Electric Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	101½	106
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
†\$1,035,000 in escrow to retire gen. mtg. bonds.						
†\$4,850,000 in escrow to retire maturing obligations.						
†\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
‡In treasury, \$80,000.						
‡Guar. by Union Ry. Co.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Jan. 17, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1906	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	104	106
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	104	106
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	103
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1906	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	110½	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Jan., 1897.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113	.....
Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	107	.....
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126	.....
Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	.....	101½
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	.....
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	115	118
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Jan. 17, 1893.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	.....
Eckington & Soldiers' Home Ry. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Jan. 17, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	91	97
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	99½	100
Crosst'n St. Ry. (Colo.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	94½	97½
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	101
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	.....	95
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	112	112½
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	91
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	116	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108½	.....
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	90	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. R. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						
*With interest						

*With Int' rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
<i>Date of Quotation—Jan. 17, 1898.</i>						
Edison Elec. Illuminating Co., Boston	2,026,000	.....	Quar.	154	.....	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	100½	.....
Pittsburg, Pa.						
<i>Date of Quotation—Jan. 17, 1898.</i>						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Jan. 17, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	111	.....
Edison El. Ilg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,156,000	1993	.....	113	.....
Edison Elec. Ilg. Co. (Brooklyn) 6s.	2,500,000	1,500,000	1940	.....	110	112
Edison Electric Light (Philadelphia) 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilg. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
<i>Date of Quotation—Jan. 17, 1898.</i>						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telephone Co. 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
<i>Date of Quotation—Jan. 17, 1898.</i>						
American Electric Heating Co. 5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 5s.	.....	.....	.....	.....	.....	25
*Barney & Smith Car Co. 10s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	75,000	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10½@10½c.; Lake, 10½@11c.; cast ing, 10½@10½c.

The Columbus (O.) Street Railway Company has declared a dividend of 1 per cent., payable February 1.

The Consolidated Car Heating Company, Albany, N. Y., has declared a semi-annual dividend of 1½ per cent., payable February 15.

The Postal Telegraph & Cable Company has decided to expend \$1,000,000 on the extension of the company's system in the West and Southwest.

The Edison Electric Illuminating Company of Boston has declared a regular quarterly dividend of 1½ per cent., payable February 1. Books closed January 15, reopen February 2.

By a vote of the trustees at Boston on the 14th inst., 1,070 shares of the preferred stock of the Street Railway & Illuminating Properties were drawn for redemption, leaving 2,559 shares outstanding.

The Bramley bill repealing the Rogers 50 year franchise law, which had passed the Ohio House, when brought up in the Senate met with strong opposition and was finally referred to a committee of five to report at an indefinite time in the future.

The aggregate receipts and expenditures of all the lines operated by the Pennsylvania Traction Company of Lancaster, Pa., during the year ending December 31, 1897, were: Receipts, \$198,770.70; expenditures, \$189,046.19; credit balance, \$9,724.51.

Owing to the interest taken in Toronto Street Railway stock the company have decided to issue a daily bulletin of earnings, the same as that issued by the Montreal Street Railway. Each day these will be telegraphed to Montreal and will be posted in the Montreal Stock Exchange.

The Albany (N. Y.) Street Railway Company reports for the quarter ended December 31, 1897: Gross earnings, \$157,987; operating expenses, \$102,725; net earnings, \$55,262; other income, \$598; total income, \$56,070; fixed charges, \$24,963; surplus, \$31,107. In 1896 the surplus was \$34,729.

Hirsch Brothers & Co., bankers of Chicago and New York, have awarded to Louis K. Enright of Chicago the contract for the construction of twenty-eight miles of electric railway between Carson City and Cripple Creek, Col. The road is to cost \$1,000,000 and will be completed in four months.

The West Orange (N. J.) Electric Company has concluded a deal by which it has come into possession of the entire property of the Orange Mountain Traction Company, including the cable road up the mountain side, which has stood idle for a year and a-half. The West Orange Company will equip the road with new steel cables and expects to open the line for traffic before the end of February.

The fifty-sixth semi-annual volume of the "Financial Chronicle," containing weekly issues of the last six months, is now ready for delivery. It contains also the quarterly issues of the investors' and the street railway supplements, the semi-annual supplement relative to State and city securities, and the monthly quotation supplement, the whole making a book of about 2,500 pages.

The Columbus (O.) Street Railroad reports gross earnings for December of \$56,276, an increase of \$3,753 as compared with the same month of the previous year, and net \$31,242, an increase of \$4,698. For the year ending December 31 the gross earnings were \$609,681, a decrease of \$20,220 as compared with the corresponding period of the previous year, and net \$322,805, an increase of \$1,349.

Among the bills introduced in the House at Trenton, N. J., on Monday last were three by Mr. Bauer: Providing for five cent fares over all connecting trolleys or other street railways in first-class counties; requiring all street and trolley cars to be equipped with heating and ventilating apparatus under penalty of \$100 fine for each day's violation; requiring street and trolley companies to maintain waiting rooms and transfer stations under penalty of \$50 for each day's violation.

The North Chicago Street Railroad Company earned last year 14.47 per cent. on its capital stock, against 15.07 per cent. in 1896. There was a slight reduction in the passenger receipts, but this was about offset in a cut in operating expenses. In the item of charges, including railway rentals, taxes, interest, insurance and loss on World's Fair stock and Connelly motors, there was an increase of a little over \$100,000, the amount in 1896 being given as \$524,231 and this year as \$636,462.

The proposition that the Union Traction Company of Philadelphia made to the Hestonville, Mantua & Fairmount Passenger Railway Company was as follows: "The Union Traction Company agrees to lease the Hestonville road for a period of 999 years, from January 1, 1898, at a net rental of 6 per cent. on the preferred stock and 4 per cent. on the common stock, free of tax, payable in gold semi-annually, in July and January." A meeting of stockholders of the Hestonville road is called for January 27 to vote on the lease.

The Boston Board of Gas and Electric Light Commissioners have authorized an issue of new stock by the Boston Electric Light Company to the amount of \$800,000, for the construction and equipping of a new central station, etc. The order provides that the sum shall be applied to the payment of liabilities incurred since December, 1897, or which may be incurred hereafter for the purchase of additional real estate, the building of a new generator station thereon, the equipment of the same, connecting them with the other stations of the company, the purchase of additional machinery and apparatus for use in said station, or in connection therewith, and for no other purposes. The market value fixed for the stock, and at which the stockholders must take it, is \$100 per share, and if there is any stock left after the stockholders have taken what they are entitled to take, it shall be offered to the public at some place in the city of Boston.

At the annual meeting of the stockholders of the Springfield (Mass.) Street Railway Company on the 12th inst. it was voted to increase the capital stock by an issue of 3,000 shares, which, according to the probable rate of sale, means an increase of \$150,000. The increase is directly made necessary by the need of \$300,000 with which to pay for the road building and extensions of 1897. "It is not anticipated," says the Springfield "Union," "that the increase in capitalization will in any way affect the usual dividends of the year, as calculations of increased earnings corresponding with expenses are made. At the ratio of an 8 per cent. dividend, which it has been customary for the company to declare in the past few years, holders of shares of the new issue, supposing that they pay for the same \$150, may expect to receive dividends for the year of about 5½ per cent. The company has already issued a total of 11,667 shares, which, with the new issue, will give the capitalization close to \$2,000,000."

The Rapid Transit Commissioners met in New York on Monday last to receive the report of the sub-committee on contract, which for several weeks has been trying to plan some method of getting a bidder for the proposed underground road. President Orr, who is a member of the sub-committee on contract, said before the members went into secret session that the report was a long one bearing upon the capacity of the Commission to proceed with the work in the face of the decision of the Appellate Division of the Supreme Court requiring the contractor to give a bond of \$15,000,000 for the faithful performance of the work. "The report," said Mr. Orr, "recommends that our lawyers go before the Appellate Division of the Supreme Court and ask the Justices to interpret their recent decision to mean that the big bond be given only for the period of actual construction of the road, and not for the fifty years in which the road is to be operated for the city by the contractors."

ELECTRICITY.

Vol. XIV.

NEW YORK, JANUARY 26, 1898.

No. 3

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As *ELECTRICITY* reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

Help to fight the Electrical Trust by subscribing for *ELECTRICITY*.

CONTENTS.

Editorial Notes,	31-33
Electricity and Trunk Line Railroads.	
Several New Illuminants.	
The Milwaukee Convention.	
Under the Searchlight,	34
A Westinghouse Inspiration.	
A Timely Decision—Is It to be Brought to Bear on the Manhattan Contract?	
Washington Notes,	35
National Association of Manufacturers,	35
Sixth Annual Convention of the Northwestern Electrical Association,	35
Power House for the Naval Academy,	38
Unipolar Self-Exciting Alternator. By J. L. Rontgen,	38
The Midland Railway's Electric Lighting Plant at Leicester,	39
Tramway Power from Lighting Stations—What is a Fair Price to Charge?	40
Electrical Activity in Texas,	41
London Notes,	41
Telegraph Rates from Europe to Jamaica.	
Principles of the Electric Telegraph.	
Underground Railways for London.	
London's Maximum Current Demand.	
General News,	42
Personal and Miscellaneous.	
Recent Company Elections,	43
Commercial Paragraphs,	43
Incorporations,	43
Electrical Patent Record,	44
Telephone and Telegraph,	44
Electrical Securities—Stocks, Bonds, Etc.,	45
Notes for Investors,	48

EDITORIAL NOTES.

Electricity and Trunk Line Railroads.

The impression that has all along more or less prevailed, that electricity could be economically applied to heavy railroad traffic, has been fostered to a great extent not only by sensational newspaper articles, but, sad to relate, by contributions that have appeared from time to time in various technical magazines, written by fairly well known engineers. There is not the slightest doubt but what in some cases electricity can be advantageously substituted for steam, as for instance in mill work, where numerous small machines are being driven by shafting; but when it comes to equipping a trunk line railroad with electricity the interest on the large sums of money that would have to be invested in copper and in building power stations would be considerably greater than the cost of the fuel saved. The New York *Sun* recently published an interview with an electrical engineer who refers to this matter as follows:

"The real reason why the electric locomotive does not at once take the place of the steam motor is the difficulty and cost of distributing the electric current for long distances without a great loss of current through the electrical resistance of the wires. To overcome this the roads operated by electricity are divided up into short sections, and separate copper feeder wires are run from the power house to each section. This would not entail so much expense if it were not for the fact that each feeder wire as it is increased in length must also be increased in size, or there would be a great loss of power, and the cost of the copper soon gets to be too great to warrant the increase in size. When the scheme for building the Broadway underground rapid transit railroad was being investigated by a Supreme Court commission in 1895 experts testified that to transmit the enormous amount of power which would be required for the proposed train service would take \$7,000,000 worth of copper wire alone if the power all came from one station."

The above statement exactly covers the point in question. Regarding the Broadway underground rapid transit railroad mentioned, it would naturally be more economical to construct several power stations and thus reduce the distance a wire would have to run and consequently the resistance; but in the case of a railroad, say one hundred miles in length, a large number of stations would have to be built at short intervals apart and at great expense, or an immense amount of copper used at an enormous cost. Referring to the impracticability of operating long lines by electricity, the article previously referred to says:

"With the present equipment it seems that 500

or 600 volts at most is the limitation of the direct current motor, and long lines can only be operated by placing power stations at frequent intervals, say ten or twelve miles apart. The transmission at this voltage involves enormous losses or great expense for copper. On one road recently tested the voltage varied from 525 volts near the station to 240 volts at the end of a line seven miles distant. It is obvious that for transmission alternating currents must be employed. How necessary high voltages are may be seen from a little calculation on the cost of copper for line wire. Mr. Stillwell gives the cost of copper required to deliver one horse power at motor shaft ten miles from the generator, allowing a 20 per cent. drop and copper 15 cents per pound, at 500 volts, \$780.75, and at 10,000 volts, \$1.95. Thus it is seen that it costs 400 times as much to furnish copper at 500 volts as it does at 10,000."

Take for example the New York-Philadelphia section of the Pennsylvania Railroad. If this company desired to operate the road by electricity, running daily the same number of passenger trains at the same horse-power that are at present being run, the cost of copper, were the line operated from one power station with a direct current at a pressure of 500 volts, would be about \$50,000,000. Of course it would be absurd to undertake to operate such a line with but one central station (or with any number for that matter), but the above figures give some idea of the impracticability of such a proposition. If an alternating current of 10,000 volts were generated at stations, say twenty miles apart, along the line, and this alternating current were transformed at short intervals into a direct current of 500 volts, which would necessitate the placing of a large number of transformer stations all along the road, the cost of copper would amount to not less than \$600,000. The cost of five central stations of 2,500 HP. each would not be less than \$625,000, and twenty-five transformer stations of 1,000 HP. would probably cost in the neighborhood of \$125,000. This would make as the total amount \$1,350,000 that would have to be expended were the same number of passenger trains (about seventy a day) to be operated by electricity as are now being run by steam, taking as an average 500 HP. per train. We have purposely refrained from taking into account the freight traffic, which would necessitate considerably more copper and larger central stations, and have confined ourselves exclusively to the passenger service, assuming that there might at certain hours be as many as twenty-five trains on the line at one time. The interest at 5 per cent. on \$1,350,000 would amount to \$67,500 a year. This sum would have to be more than offset by the annual saving in fuel in order to make the electric system a success financially. Assuming a locomotive burns coal at the rate of 5 lbs. per horse-power hour for three hours in making a trip from New York to Philadelphia or vice versa, the total

amount of fuel consumed annually, were seventy trains of 500 HP. each run a day, would be 85,519 long tons. At \$3 a ton the coal item would amount to \$256,557 a year. With electricity as motive power, the five central stations would be obliged to operate at their full capacity during nineteen hours out of the twenty-four. With but two pounds of coal consumed per horse-power hour, the total amount of fuel burned per year would be 77,380 tons. Figuring this at \$3 per ton, the annual coal bill for generating the necessary electric current would be \$232,140. There would therefore be an annual saving were electricity adopted of \$24,417 in fuel. But the interest on the capital which it would be necessary to invest to effect this saving of \$24,417 amounts to \$67,500. There would therefore be an annual loss of \$43,083, to say nothing of the extra amount of labor required in operating the five power stations and inspecting the working circuits on ninety odd miles of track.

From the above figures it will readily be seen that the time is not yet ripe for the substitution of the trolley or any modification of it for steam on trunk lines, or over long distances where the train service is infrequent. Mr. C. E. Yerkes summed this question up in a nutshell recently in the *Pittsburg Dispatch* as follows:

"I do not clearly see the finish, using a common slang expression, of the steam locomotive. It is a very perfect machine, and certainly no electrical invention has yet been made which will take its place for long-distance hauls. The present steam locomotive is far ahead of the present electrical locomotive. Of course the third-rail system has been used to advantage in short hauls, but for the long-distance strides over continents, as, for instance, this limited train of the Pennsylvania Railroad, the electric locomotive is as yet only a dream."

Great things are expected of the alternating-current motor in the near future, but even were this apparatus adapted for railway work, which it is not at the present time, there is no certainty that a trunk line railroad could be operated more economically even then by electricity than by steam when the extra labor item is taken into account.

At the present state of the art electricity can unquestionably be advantageously applied to special cases, but if we overstep the boundary by which we are confined we are simply wasting energy and money to no purpose.

* * *

Several New Illuminants. The old saying that it never rains but it pours would seem to apply admirably to inventions. A wonderful illuminant recently made its appearance in Germany, and two such inventions are now attracting attention in this country. Mr. D. Macfarlane Moore, of Newark, N. J., is said to have solved the problem of vacuum-tube lighting without shadows. A test was recently made of this method of illuminating which would seem to prove conclusively that the light was under thorough control and could be so regulated as to give any desired degree of intensity—from a soft, clear light resembling that given off by the moon to an intense glare by which photographs could readily be taken. The principal advantage claimed by the inventor for this improved method of vacuum-tube lighting is that it diffuses itself evenly throughout a room and does away with the objectionable flicker. As is well known, a vacuum-tube light is generated by the action of electricity upon the particles of ether in a tube. For many years scientists have been endeavoring to turn this principle to practical use, but it has been found extremely difficult to do so. Mr. Tesla has done considerable work along this line, and a few years ago succeeded in obtaining a vacuum-tube light by the aid of which he was enabled to photograph various objects. Mr. Philip N. Jackson, of Newark, refers to Mr. Moore's invention in one of the local papers as follows:

"At the Electrical Exposition in New York in 1896 I saw the light, and it was the nearest counterpart of daylight I ever saw. Mr. Moore is a remarkably bright young man. If he has succeeded in perfecting vacuum-tube light so that it will be practical he has achieved a great thing.

"Scientists, electricians and all electric-light people agree that the light of the future will be a steady and diffused light with no flicker, instead of the spot lights now in use. Of course, I do not know whether Mr. Moore has succeeded in solving the problem so that his light is cheap and practical, but if he has he will win fame and fortune.

"A practical vacuum-tube light would be of great value to electric light companies, for the power for Mr. Moore's light is generated as we generate power for our light. If he has succeeded, his light will make a wonderful change in all illumination."

At the coming Electrical Exhibition, to be held in Madison Square Garden next May, Mr. Moore expects to demonstrate to the public the practicability of his vacuum-tube light by illuminating the arches and stained-glass windows of a specially-designed Gothic church. If, as Mr. Jackson states, this light can be generated economically, there would seem to be no reason why it should not be universally adopted and prove a benefit to mankind.

The other new illuminant which we referred to above has lately been invented by Mr. S. N. Nickum, of Logansport, Ind., and if we are to believe all the newspaper reports regarding it, it would certainly seem to be a wonder. The *Chicago Tribune* describes the light as follows:

"As near as can be learned, the new light is a product of some chemical action hitherto unknown. It is given off, according to the tales of eye-witnesses, from round glass globes sealed up from the air and apparently disconnected from every possible source of illuminating energy. These globes can be carried anywhere desired, exposed to light or darkness, heat or cold, all without changing the steady illumination from within. They are made in sizes ranging from that of a small egg up to the dimensions of an arc light covering. Some are dim and soft, being a fraction of a candle power, while others glow with the brightness of an Argand burner. Any color of glass in the globes may be used, and thus hue, size and brilliancy may be completely at the control of the manufacturer. And as long as the globe remains intact the light is declared to endure in its original brightness."

The inventor has up to the present time carefully kept secret the combination of chemicals which it is claimed he uses. Many persons think Mr. Nickum has solved the problem as to how phosphorescence is produced, and discovered the chemical action which takes place during its continuance. The principal cause that has led to this belief is the fact that only the slightest discernible rise in temperature accompanies the giving off of the light.

The claim which the inventor makes, to the effect that the light once started will never go out so long as the glass bulb in which the chemicals are located remains intact, would seem more or less absurd. The giving off of light must necessarily be the result of some action which the chemicals in the tube are undergoing, either in combining or in being decomposed, and such being the case it is difficult to see how such an action could keep going on indefinitely without ultimately exhausting one or all of the chemicals. If Mr. Nickum can do what he claims, he has certainly succeeded in accomplishing something that no one else has ever been able to secure, namely perpetual action, which is the next thing to perpetual motion.

Several daily papers with their usual sensational gusto have intimated that this new illuminant may be the death knell to gas and electric lighting companies throughout the country, but we scarcely think stockholders in the latter organizations need be in any hurry about ridding themselves of their securities.

The Milwaukee Convention. The Milwaukee meeting of the Northwestern Electrical Association, to which we devote considerable space in this issue, was a complete success from every point of view. The attendance was large, forty-six applicants for membership were admitted, and a number of valuable papers were read. The discussions were conducted in an admirable spirit and the members who took part in them seemed to be actuated by a desire to learn as well as to instruct. The attention this organization continues to attract in all parts of the country indicates a healthy growth and fast-spreading influence.

Under the Searchlight.

Notes and Comments on Various Topics.

A Westinghouse Inspiration?

In a long article entitled the "Tammany Rapid Transit Deal," which recently appeared in the *Philadelphia Press* and which was subsequently copied in the *New York Post*, the various steps that presumably led to George Gould deciding to equip the Manhattan Elevated Railroad with electricity are set forth. The writer of the article hints at an all-around deal having been made between Tammany as represented by Mr. Richard Croker, Mr. Gould, representing the interests of the Manhattan Elevated Road, Mr. Whitney for the Metropolitan Street Railway Company, and the various political members of a certain Cleveland electrical manufacturing company. According to the writer of the article referred to, the killing of the underground rapid-transit scheme and Mayor Van Wyck's recommendation in his first message regarding the Elevated Railway system were all arranged at Lakewood between Mr. Croker and Mr. George Gould. This long-winded article intimates that a subsequent deal was made with the Cleveland company by which it was to get the contract for installing the electrical apparatus for a small consideration in stock, which latter was to be distributed among a few of the Tigers. The tone of this article would seem to be somewhat on the sour-grape order. The effusion referred to ends as follows:

"The mechanical engineers say that there may be complications in case the contract is awarded to the company controlled by this group of politicians, for these engineers declare that it will be impossible to equip the elevated structure with electricity without employing some of the apparatus invented by Tesla which this company does not control. It cannot use these patents, it is asserted, without making itself liable to suits for infringement, unless it buys the right to use them. Perhaps it has made contracts for such use. If so, it, of course, will escape the embarrassments of litigation. There are some men on Wall Street who wonder whether this is not after all a brilliantly arranged plan for inducing the public to buy the shares of the corporation, and yet if the corporation secures one contract involving the payment of ten millions, or thereabouts, there is no reason why the public should not receive in the way of good dividends its share of the profits which are in the contract."

* * *

An Overdone Specialty.

There are twelve different concerns engaged in the manufacture of rheostats as a specialty in this country. The first one began business in June, 1892, less than six years ago. It is evident that there is not room enough for more than two or three concerns in such a limited line. This is a good illustration of how the electrical manufacturing business has been overdone in the last few years.

It looks as though a fight to the death has started in, as nearly every one of these concerns is suing or being sued under alleged controlling patents, and now the prices are reduced so that a 1 HP. automatic

rheostat can be purchased in the open market for \$3.50. Three or four concerns who have entered this field have quietly subsided, and it looks as though many others would be obliged to soon follow suit. Economical secret processes are really the only protection under such conditions, as patent litigation is so uncertain and expensive and long drawn out that it offers no sufficient protection, and the reductions in price in the struggle for existence leave the industry crippled for years to come.

The rheostat business is not by any means the only line overdone in this way. "There are others."

* * *

A TIMELY DECISION.

Is It to be Brought to Bear on the Manhattan Contract?

Judge Wheeler of the United States Circuit Court handed down a decision on January 24 sustaining the validity of the electric railway motor suspension patent, which is controlled by the General Electric and Westinghouse Companies, and ordering an injunction against the Union Railway Company of this city and the Walker Company of Cleveland, Ohio.

The Union Railway is commonly known as the "Huckleberry Road," in which Mr. A. W. Brady, of the Walker Company, is largely interested. The decision has little or no significance, as the case will unquestionably be carried to a higher court.

* * *

In the issue of January 20 of the *Electrical Engineer* there appeared a lengthy illustrated article describing the new station of the Edison Electric Company of New Orleans. The names of the officers of this company were given in this article, but the names of most of the directors of the company were withheld. It may interest our readers to learn that most of the stock of the above organization is owned by the General Electric Company, and we presume the latter has adopted this method of drawing public attention to the plant as a preliminary step in a contemplated booming process.

* * *

THE *Commercial America*, New York, in its issue of January 21 says:

It may startle investors in electrical securities somewhat to learn that the owner of a prominent machine works in this country states that he recently attempted to make electric motors, first for his own use, then for the trade; but the best he could do was to produce them at nearly double the cost of the motors in the open market. In other words, these large and well-fitted-up machine works were forced to the conclusion that there is not only no money in such business, but actual loss. Interviews on this head with other machine supply establishments corroborate the opinion above expressed, it being added that they thought the big electric manufacturers are forcing the smaller firms to the wall deliberately to destroy competition.

Another manufacturer stated: "It is the natural result of over-production, or of there being in existence more motor manufacturers than there are buyers for output. We do not see any more in this cutting of prices than the usual supply and demand for motors. At the same time, we confess that motors are being sold to-day at a price which those not in the business can see no profit in. Of course, if these motor manufacturers have some secret by which they can produce motors at 33 or 50 per cent. less cost than can outside machinists this criticism has no point or application."

The great secret referred to in the last passage of the above article is that some electrical companies manufacture not only machinery but stocks and bonds as well. Such being the case it matters little to them whether a profit is made on their electrical apparatus so long as their other commodity finds a market. Whenever the General Electric Company stops carrying on a stockjobbing business, the price of its dynamos and motors will necessarily go up and smaller concerns will then stand some show.

We would call attention to the recent loss met with by the Sterling Remedy Company of Attica, Ind. Owing to a fire which broke out in one of the packing rooms, the building in which the offices of the company were situated was totally destroyed.

This misfortune, however, only served to stimulate the management to greater effort, with the result that it was only a few hours after the fire started before the company was again carrying on business as before in a new set of offices. The record of this company would appear to be something phenomenal, for according to the annual report of the board of directors there were over 3,000,000 boxes of cascades sold during the year 1897, and it is stated that there are good prospects of doubling this business during the present year.

WASHINGTON NOTES.

Representative Wheeler of Alabama has introduced a joint resolution to fill one of the vacancies in the Board of Regents of the Smithsonian Institution by the appointment of Alexander Graham Bell to succeed Gardiner H. Hubbard, deceased.

Mr. Wheeler has also introduced a bill providing for the establishment of the Morse Memorial Conservatory of Electricity; the bill also provides that the commissioner of promotion having the matter in charge procure from each State, by public or private contribution, a fund sufficient to provide one perpetual free scholarship in the Conservatory.

National Association of Manufacturers.

We called attention in our issue of the 5th inst. to the banquet of the above Association, which is to take place at the Waldorf-Astoria Hotel on the evening of the 27th inst., and in advance congratulate those of our electrical friends to whom an invitation has been extended, for they will meet there a company of bright, able men whose names are intimately connected with the manufacturing and commercial progress of the country. President McKinley is expected to be present and to speak.

The National Association of Manufacturers was formed in 1895 and now embraces in its membership 1,000 of the largest manufacturing interests in the United States. Its chief object as set forth in a pamphlet issued by the "Bureau of Publicity" of the Association are: The conservation of the home market; creation of a Federal Department of commerce and industry; improvement of patent laws; unification of railroad freight classification; enactment of a uniform bankruptcy law; improvement of internal waterways; investigation of foreign markets; establishment of sample warehouses; improvement of the Consular service; restoration of the American merchant marine; restoration of treaties of reciprocity.

An annual fee of \$50 entitles a manufacturer to membership and to all the privileges incident thereto during the period of twelve months from the date of payment. Only manufacturers are eligible for membership.

Electric Light Dimmers.

Electric lights for household use have always heretofore been open to the objection that they could not be turned down without putting them out. Recently this objection has been overcome and a number of manufacturers are now offering for sale sockets for incandescent lamps which enable a person to regulate the amount of light produced within wide limits.

These sockets can be put in place of the ordinary ones with little trouble or expense, and the light given out by the lamps which they carry can be regulated as readily as can a gas jet. This result is attained by the introduction into the socket of coils of fine wire which act as resistance coils. In one style of these sockets there are five of these coils and the light of a sixteen candle-power lamp can be reduced by two or three candle-power jumps down to two candle-power. The work of a resistance coil is to absorb some part of the electrical current which seeks to pass through it, allowing only the remaining force to act upon the carbon filament of the lamp to produce heat and consequently light.

Lamp Company in Trouble.

As we go to press it is rumored that a Boston Lamp Company is in trouble.

THE SIXTH ANNUAL CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

The Sixth Annual Convention of the Northwestern Electrical Association was held in the club room of the Hotel Pfister, Milwaukee, Wis., January 19, 20 and 21.

The Convention was called to order on the 19th at 11 A. M. by the President, Mr. H. C. Higgins, of Marinette, Wis.

The roll was then called by the Secretary and the following were announced as present:

H. C. Higgins, Marinette, Wis.
Henry L. Doherty, Madison, Wis.
B. H. Strong, Baraboo, Wis.
S. B. Livermore, Winona, Minn.
Fred D. Nims, Muskegon, Mich.
E. W. Buss, Chapman Valve Mfg. Co., Chicago.
E. L. Draffen, Chicago.
W. L. Church, Milwaukee.
W. P. Bragg, Monroe, Wis.
H. T. Pearce, Negaunee, Mich.
J. L. Schlacks, Freeport, Ill.
F. A. Copeland, LaCrosse, Wis.
Adolph Hamacek, Sturgeon Bay, Wis.
Pliny Norcross, Janesville, Wis.
M. B. Austin, Chicago.
Frank Kellogg, Spence, Ill.
E. A. Upham, Marshfield, Wis.
T. A. Pamperin, Oconto, Wis.
George A. Davis, Neenah, Wis.
R. T. Schuchardt, Chicago.
Charles S. Kehler, Milwaukee.
C. C. Paige, Oshkosh, Wis.
Alex. Dow, Detroit, Mich.
L. E. Kerns, Madison, Wis.
Frank L. Perry, Chicago.
W. P. Upham, Chicago.
George L. Mayer, Belle Plaine, Ia.
G. W. Patterson, Chicago.
J. H. Harding, LaPorte, Ind.
Edward R. Grier, Chicago.
George S. Searling, Chicago.
A. A. Cross, West Superior, Wis.
C. E. Van Bergen, Duluth, Minn.
J. D. H. Ralph, Owosso, Mich.
A. W. Foster, Chicago.
George S. Whyte, Chicago.
James R. Dee, Houghton, Mich.
Fred DeLand, Chicago.
C. T. Gage, Chicago.
W. Worth Bean, St. Joe, Mich.
W. Worth Bean, Jr., St. Joe, Mich.
A. B. Conover, Chicago.
H. O. Channon, Quincy, Ill.
E. H. Hammond, Chicago.
W. W. Low, Chicago.
R. E. Lucas, Marion, Ind.
George P. Rex, Chicago.
L. W. Burch, Madison.
F. L. Hogg, Madison.
John T. McRoy, New York and Chicago.
A. L. Tucker, Chicago.
A. M. Little, Chicago.
W. S. Troll, Big Rapids, Mich.
E. L. Debell, Sheboygan, Wis.
J. B. Morrill, Evanston, Ill.
C. W. Bacon, Madison, Wis.
O. P. Kissell, Hartland, Wis.
John B. O'Hara, Hartland, Wis.

The following additional attendants were registered on the 20th inst.:

A. C. Langstadt, Appleton, Wis.
F. G. Kurz, Appleton, Wis.
Otto Langstadt, LaCrosse, Wis.
C. A. Ross, Chicago.
C. E. Kaumeyer, Chicago.
H. J. Gille, St. Paul.
P. H. Korst, Racine, Wis.
W. F. Collins, Wausau, Wis.
C. R. Gilman, Milwaukee.
Morgan Brooks, Minneapolis.
Irving P. Lord, Waupaca, Wis.
D. W. Jackson, Madison, University of Wisconsin.

After roll-call a motion was made, seconded and unanimously carried that the minutes of the Fifth Semi-Annual Convention be accepted as printed.

The President then read his address, an abstract of which is as follows:

PRESIDENT HIGGINS'S ADDRESS.

Fellow-members of the Northwestern Electrical Association: I greet you and bid you a happy New Year in this the sixth year of the existence of this

Association. I am pleased indeed to see so many of you present. It bespeaks a good Convention and as President of this Association I thank you one and all for your presence here to-day. I see that the supply man, God bless him! is quite in evidence, for which I am also thankful, for I think him the saving clause of this Association. I do not know what we would do without him, and I believe in electing him to full membership.

I am a believer in Associations and frequent Conventions, and the more frequent the better. The oftener we meet and compare ideas and exchange grievances the better, and I hope that this Convention may continue to grow and meet and meet and grow until it becomes so large that there will be no building in the State of Wisconsin large enough for it to hold its meetings in excepting our amphitheater at Marinette which we are now building, with a seating capacity of 4,000 people and a stage capacity of 150 people, as in that event you will hold all your meetings in Marinette.

I trust that you have all had a pleasant and prosperous year, and I judge from your countenances that such has been the case. I am glad to be able to state that but one death has occurred in our ranks during the past year, and no company which is represented in this Association has gone into the hands of a receiver within the past year except one, and that was only temporarily. There has been no State legislation enacted that I consider particularly offensive to our business, and so far as I can learn each of the committees appointed at our last January meeting have done their work well.

[Mr. Higgins here referred to the work of the inventors of electrical apparatus and paid a high tribute to their genius. He also alluded to the manufacturers in terms generally complimentary but occasionally sarcastic.]

They have invented and sold us the excellent products of their wonderful genius, and at excellent profits to themselves, but they have neglected one very important thing, that is, directions to us of how to operate the goods with profit to ourselves, which the hazard and annoyance and the necessary investment could justify—hazardous because of the many dangerous things that can take place in connection with our plant that would be ruinous to it, such as an opposition municipal plant or a serious accident causing many thousands of dollars, a disastrous fire, etc.; and while we do not want to condemn the electric lighting business, I will say that I see before me here the faces of many men who have been in the central station electric light business for years, some of them having grown gray in it, and I do not know of more than one or two instances where they have ever realized one dollar on their many years' investment; still the public think we have too many privileges and are getting rich through the business.

When we first went into the electric light business we paid \$25 a thousand for carbons; we paid one dollar each for incandescent lamps, seventy cents for sockets, and all other supplies necessary for the business at corresponding high prices, so that I think if we are let alone our business will be fairly remunerative for some time to come. The electric watt-meter has been an excellent thing for us, and I hope the time is near at hand when electric current will be sold only by meter.

One dangerous element that we have to look out for is the political schemer, who is always working "for the dear people," and the gas and electric light companies are destined subjects of his attack. All our legislative halls from Congress down to our own little municipalities have quite a sufficiency of this element. You may ask me for a receipt for treatment of him, but I must answer that I have none other than to meet him with good work and honest facts. Give the public good service and fair prices and courteous treatment and the battle is half won.

The street railway business has, I think, suffered more within the past two years than any other legiti-

mate business. Not only has the hard times worked against them, but the bicycles have taken a large percentage of their business. It is gratifying however to street car men to know that the expenses of operating as well as those of original purchase have been very much reduced. The reduced receipts have had much to do with the reduction in operating expenses, so that perhaps after all the reduced receipts have been a blessing in disguise, although the reduced receipts have not been the whole cause of our reducing expenses, for when we first went into the electric street railway business it was all an experiment from start to finish. Everything was new to everybody, and we who have had the putting of these appliances into actual operation and have had to furnish the capital to test and bring to successful operation the different electric street railway appliances which are now running so successfully, have, I think, had as hard a task on our hands as the gifted geniuses who invented and put together the many appliances which were sold to us as the best in the market, and sold to us, as you know, at enormous prices, and even at these prices we found them defective in many ways, and we had to improve them as best we could and do the best we could with them.

We all went into the electric street railway business with the greatest hopes of financial success. It was a very attractive business. The man who was running a horse car or a mule car line would go to a town where they were running the new electric street railway; he would see the beautiful cars, with every seat occupied by a passenger, gliding over the track without any apparent effort and at a more rapid rate than he had ever hoped to accomplish on his line, a uniformed conductor on one end, a uniformed motorman on the other, with everything bright and shiny—a beautiful sight to him,—and frequently he did not go home until he first visited the office of Mr. John I. Beggs or Mr. B. E. Sunny, whose bright, smiling countenance was only a continuation of the bright things he had seen in the electrical equipment at the last town at which he had visited, and got prices from each of these gentlemen for electrically equipping his road at once. He went home, consulted his board of directors the first day, explained what he had seen and some of the things he had felt, and that night sent a night message accepting the proposition of one of the two contestants before mentioned. We all thought in those days that about all that was necessary was to secure a favorable franchise and the electrical companies would do the rest, but I know of no writing that so fittingly applies to the case as a verse in one of Moore's poems which reads:

I saw from the beach when the morning was shining
A bark o'er the waters ride gracefully on;
And I saw from that beach when the eve was declining,
The bark was still there but the waters were gone.

The nickels which we had expected to have supported our enterprise had, like the waters, gone and left our bark, the street railway, stranded.

It is not to be wondered at that after these five or six years of experiments in the business, and with approved appliances, more efficient help, etc., we can reduce the operating expenses. Every appliance in the business has been an improvement on the first, and we have all contributed something towards this result, until the business has now become one of comparative pleasure to that which it was in its early history when we were trying to operate an electric road on a horse car track with inexperienced help, who, notwithstanding their incompetency, were high-priced and indifferent, for if they were not retained by you they were pretty sure of a job at the next town having a similar business. Our rail bonds were continually breaking, our track continually spreading and letting our cars drop to the ground, and no matter how well it was cared for the track was a constant annoyance. Our commuters were niggering and our motors short-circuiting, and on our very busy days these things seemed to combine to do their worst, or rather their best, to make

us miserable. Our days were restless and our nights sleepless, but by patience and persistence we have become masters of the situation, and I think if the writer was alive to-day who wrote the sentence, "He who makes two blades of grass grow where but one grew before is a benefactor," he would add, and he who carries two passengers where but one was carried before is also a benefactor.

As I have been through the poor track and poor car business, and as one of the pioneers in the street railroad park business, I feel that it is not egotism to say that I am competent to give some advice to my fellow-sufferers in that line. Do not use less than a 60 lb. steel T rail; use good sound tires not less than 6" wide, lay them two feet centers, and still closer is better; bond with not less than No. 0 bonds, use nothing less than 0 trolley wire, buy nothing larger than 16 to 20 ft. cars for general use, and you cannot make much of a mistake by buying the latest type of generators and car equipments from any of the leading companies making and selling such appliances. Do not, however, lay any extra line in order to establish a park, unless you can establish it on the edge of a body of water and have a town of not less than 30,000 people to draw from. Do not lay out much money on animals for your park. Do not run vaudeville or other shows unless you are so situated that their transportation will cost you but little. I believe that street-railway parks should be well enclosed and no one admitted unless they pay car fare each way, no matter whether they come by carriage or bicycle. I do not believe that any town of less than 25,000 people will support an electric street railway and give a decent return to its investors; although two towns aggregating a little less than that population and being some distance apart might be good paying properties, yet local conditions would have very much to do with this. I have known of towns of this size and seemingly about the proper distance apart, and without a cent of interest to pay and light taxes, almost no insurance and lying in the heart of a good coal district where they got their coal for almost the hauling, and although the road appeared to be well managed still it went into the hands of the receiver for sheer lack of patronage and is still in his hands, and the Lord only knows when it will get out of his hands.

And now in my closing remarks in relation to electric street railroading, while congratulating ourselves upon the pleasant side of the business, I would ask how long the restless brain or the genius of the nineteenth century, or even the twentieth century, coming and already on our threshold, will let us alone. How long will it be before they will have something better to offer us for transporting passengers than an electric street railway? We are already threatened with the airship and the horseless carriage. What will be accomplished in this line is mere guesswork. Let us hope, however, that at least we who are in the business to-day will get a much needed rest from any further experiments.

Gentlemen, I thank you for your attention. The next order of business is the report of the Secretary.

The Secretary and Treasurer then presented his report and it was unanimously accepted and adopted.

On motion of Mr. Debell the election of officers was postponed to a future session.

The Secretary then presented a numerous list of applications for membership, from manufacturing and supply companies and individuals, and on motion of Mr. Norcross the Secretary was directed to cast the ballot of the Association for the admission of the applicants.

PROGRAMME.

The following was the programme arranged for the Convention:

WEDNESDAY, Jan. 19—Morning Session—Convene 10 o'clock; roll-call; reading of minutes; president's address; report of secretary and treasurer; election of officers; election to membership; reports of committees; unfinished business; new business.

Afternoon Session.—Convene 2 o'clock.

Paper—"Practice of Theory." By John C. McMynn, of Illinois.

Paper—"Electric Lighting for Profit." By Alex. Dow, of Michigan.

Address—"Topics of Interest to Central Station Men." By Lieut. Francis A. Badt, of Illinois.

7:30 P. M.—Theater party.

THURSDAY—*Morning Session*—Convene 10 o'clock.

Paper—"Long Distance Transmission." By Axel Ekstrom, of New York.

Paper—"Present Efficiency of Incandescent Lamps." By John E. Randall, of Missouri.

Paper—"Physical and Chemical Properties of Volatile Oils in Boilers." By W. H. Edgar, of Illinois.

Afternoon Session.—Convene 2 o'clock.

Paper—"Electricity in Municipal Engineering." By Prof. R. B. Owens, of Nebraska.

Paper—"Municipal Socialism." By Fred DeLand of Illinois.

8:30 P. M.—Banquet. [The following is a list of the toasts and speakers: "The Badger State," response by Governor Scofield; "The Cream City," response by City Attorney Van Wyck; "The Electrical Press," response by Frank L. Perry; "The National Electric Light Association," response by W. Worth Bean; "LaCrosse and Hospitality," response by F. A. Copeland; "The Light that Failed," response by H. L. Doherty; "The Girls We Left Behind Us," response by H. G. Underwood; "Ourselves," response by W. W. Low.]

FRIDAY—*Closing Session*—Convene 10 A. M.

After the programme was announced the Convention adjourned to meet again at 2:30 P. M.

WEDNESDAY—*Afternoon Session.*

The session was called to order by the President at the hour set.

The President appointed W. W. Bean, chairman, H. L. Doherty and Pliny Norcross a committee to nominate officers and directors for the ensuing year.

The committee reported as follows:

For President—F. A. Copeland, of LaCrosse.

First Vice-President—James R. Dee, of Houghton, Mich.

Second Vice-President—P. H. Korst, of Racine, Wis.

Secretary and Treasurer—Thomas R. Meroein, of Milwaukee.

Directors—E. L. Debell, of Sheboygan, Wis., chairman; George L. Thayer, of Belle Plaine, Iowa; S. B. Livermore, of Winona, Minn.

On motion of Mr. Bean the rules were suspended and by unanimous vote these officers were elected.

Mr. Copeland, the new President, was then conducted to the chair and made a brief address in which he acknowledged the honor conferred upon him, spoke of the good that was being done by the Association, urged the members to increased efforts towards swelling the roll, and advised all engaged in the electric light and railway business to connect themselves with the Association.

Mr. Pliny Norcross, chairman of the Protective Committee, then presented the report of the committee, which was a statement of what had been done by it to prevent hostile legislation at Madison and elsewhere. It deplored the indifference manifested by a large majority of the companies, and urged a more general effort for protection against legislative schemes that threatened their interests.

The Committees on Ways and Means and Municipal Ownership not being ready to report, further time was granted.

On motion of Mr. Debell the report of the Committee on Entertainment and Programme was accepted as printed.

A discussion followed in relation to excursion projects, and several letters were read inviting the Association to hold its June meeting in Duluth or West Superior, Mr. Hill of Chicago making a strong

plea in favor of those cities, which are only a few miles apart.

Mr. Bean—I do not want to interfere with the papers in any way, shape or form, but there are a number of valuable papers to be read before this Association, and therefore I move that the matters which have just been considered be referred to a committee of six to be appointed by the chair, and that the subject be brought before the meeting at a later hour.

The motion was seconded and unanimously carried.

The Secretary moved that C. E. Van Bergen, F. S. Walker and J. M. Hill, of Chicago, be transferred to the active list of membership.

The motion was seconded and unanimously carried.

A paper was then read by Mr. Alexander Dow, of Michigan, on the subject of "Electric Lighting for Profit."

A brief discussion followed.

The subject of municipal ownership was then taken up and discussed.

The President then appointed as committee on location of summer meeting, to consider the invitations which had been presented and to make report to the Convention, Messrs. Bean, Norcross, Livermore, Debell, Higgins and Paige.

Several applications for membership were presented and the applicants duly elected members of the Association, after which the Convention adjourned until 10 o'clock A. M. Thursday.

THURSDAY—*Morning Session.*

The meeting was called to order at 10:40, President Copeland in the chair.

A number of applications for membership were presented and favorably acted upon.

The Secretary—I would like to have the Association consider the question whether an active member who is the owner of a plant, where the plant itself has not been admitted to membership, can appoint a proxy to represent him at the Convention.

The President—I understand if any individual is an active member it includes his plant really. They take the membership in their own names instead of the names of the plant, and I consider that it really means the plant, and I should say that it would be proper to admit them.

Lieut. Francis A. Badt, of Illinois, then made an address on the subject of "Topics of Interest to Central Station Men."

[Mr. Badt's paper was exceedingly interesting and deserves printing in full, but lack of space compels us to defer its publication and that of others read at the Convention to a future issue.]

The thanks of the Convention were unanimously tendered to Lieut. Badt for his address.

Mr. W. M. Edgar, of Illinois, then addressed the Convention on the subject of "Physical and Chemical Properties of Volatile Oils in Boilers," which was discussed at length.

A vote of thanks was extended to Mr. Edgar for his valuable address.

Mr. DeLand then read a paper written by Mr. John C. McMynn, of Illinois, on the subject of "Practice of Theory."

A letter from Mr. Henry C. Payne, regretting that, owing to the advice of his physician, he would be unable to attend the banquet, was read.

A paper was then presented on the subject of "Present Efficiency of Incandescent Lamps," by Mr. John E. Randall, of Missouri.

During the reading of the paper Mr. Randall said: "I do not believe it is generally known that the ordinary gas burner decreases very markedly in its efficiency after a very short time; an entirely new tip will give a much brighter light than one that has been used a comparatively short time. That is true of all our illuminating devices in gas. The Welsbach mantle is a remarkable instance; it has an intense brilliancy for a short time, which is very quickly lost."

A unanimous vote of thanks was extended to Mr. Randall for his able paper.

A recess was then taken until 2 P. M.

THURSDAY—*Afternoon Session.*

The Convention was called to order at 2:30 by the President.

A paper on the subject "Electricity in Municipal Engineering," by Prof. R. B. Owens, of Nebraska, was then read for him, and a unanimous vote of thanks was extended to Prof. Owens for his paper.

A paper on the subject of "Municipal Socialism" was read by Mr. Fred DeLand, of Illinois, and was followed by a discussion. Mr. DeLand was thanked by unanimous vote for his paper.

Mr. Bean—Prof. Jackson of the University of Wisconsin is here and he has valuable information on the subject of depreciation, and we want to hear from him. I desire, however, first to draw your attention as station managers to what Mr. Dow said yesterday. I made the motion to receive his valuable paper, and I would like to have had more time to discuss it among us for our own benefit. He said, if I am not mistaken, that it was about \$86 or \$89 that it cost the city of Detroit for each lamp, with only 4 per cent. allowed, as stated by Mr. Doherty, for depreciation on boilers. Well, if the city of Detroit is running an electric light plant with nothing to depreciate but boilers, I am going to Detroit to learn how to run a plant; and I want the central station men to bear in mind in talking to their neighbors and advocates of municipal ownership that the city of Detroit is not getting lights at the rates named on paper. The statements are very misleading. No provision is made by Detroit in the way of forming a surplus, and without a surplus how can they renew their plant? They cannot do it? I trust you will bear that in mind. The city of Detroit does not get lights at the figures claimed, as they make no allowance for depreciation except that mentioned.

Prof. Jackson then delivered an address on "Depreciation," and was loudly applauded as he finished. A discussion of the subject followed.

Mr. Thayer—I have in my hands a batch of seventeen reports, such as they are—I should not call more than two of them real reports—from municipal plants in the State of Iowa. Some six or eight weeks ago I was written to by the secretary of some syndicate of Eastern capitalists who were about to lose their city service in Tonawanda, N. Y., on the ground of the excellent showing of the Marshalltown plant, which is alleged to be running at lights for \$18 a year. (Laughter.) Now I have out of that list three or four reports that are sufficiently explicit so that we can draw some deductions from them.

[Mr. Thayer gave all the material facts contained in these reports and pointed out their inexplicable differences in the cost of operation and general results. He concluded his remarks as follows: "The conclusion I want to draw from this is, that the city officials of these smaller plants are business men and not electric light men, and while they are honest in their intentions they do not know what their business is costing them, and when they send out reports like these it injures every plant in the vicinity, because the cost of light is reported as being low, and citizens say the light costs about double of what it should, and something is wrong; prices ought to go down. It is our duty, I think, wherever there are any municipal plants anywhere near us to either visit them or get somebody who knows something about it to go there and get the actual operating expenses. I have done that in a few cases and there are a few plants that have promised me when their annual reports are out to give me full reports of the whole thing, and I think at the next meeting we can get a few of these reports and bring them in and have them printed in our regular proceedings, and they will be very useful afterwards as works of reference."]

A long discussion upon municipal lighting plants took place at this point, the consensus of opinion

being that the statements made by municipal officials are defective in essential points and thoroughly misleading.

A vote of thanks was extended to Mr. DeLand for an offer of books giving information in regard to municipal ownership and for the efforts that he has made on behalf of central stations.

The President—If you all feel as I do now, I think that you realize that you have got more for your money in the last hour than you ever got for that amount of money in your life before, and any member of this Convention that has not been in the hall during this talk does not know how much he has lost; and I would suggest for the benefit of the Entertainment Committee next year that when we go into session we remain in session until we get through.

On motion of Mr. Bean the Convention went into executive session.

The report of the committee on midsummer meeting was then presented, and recommended that no midsummer meeting be held in 1898. The report was accepted and committee discharged.

Mr. Doherty—I move that a committee of five be appointed and that this matter be referred to them with full power to act and that they be clothed with the full power of the Association, a decision to be reached by the 1st of April, 1898.

Motion seconded and carried.

Mr. Doherty—I move that a vote of thanks be tendered Mr. Hill for the remarkable work he has done in behalf of this Association.

Motion seconded and unanimously carried.

A motion was made that the President and Secretary of this Association be appointed to attend the next session of the National Association at Chicago, Ill., to represent this Association in that body.

Seconded and unanimously carried.

Mr. Bean—As chairman of the Committee on Municipal Ownership, I wish to say that the Government is getting out a report and the Hon. Carroll D. Wright, Commissioner of Labor, will put his sanction upon that report, and it depends upon every central station man whenever this blank is sent to him to fill it out. There is a different blank for municipalities. Remember that when the United States Government puts its stamp on this report that is the end of it.

The President—This blank should be filled out as absolutely and completely as possible. The reports of course are made in absolute confidence.

A number of additional members signed the register.

An adjournment was here taken to 10 A. M. Friday.

FRIDAY'S SESSION.

The Convention was called to order by the President at 10 A. M.

The President appointed as the committee referred to yesterday to consider the question of the midsummer meeting, Messrs. Norcross, Doherty, Dee, Korst and Hill.

Adjourned sine die.

Power House for the Naval Academy.

Assistant Secretary of the Navy Roosevelt in a letter to the Secretary of the Navy states that among the immediate and pressing needs at the Naval Academy at Annapolis is a power house. He says: "We need a first-class power house. The present buildings are makeshifts and ought to be replaced. This will cost \$100,000, and \$90,000 will be required for the grading, the electric light wiring, removing old buildings, etc., as rendered necessary in carrying out the work of building."

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

UNIPOLAR SELF-EXCITING ALTERNATOR.*

BY J. L. ROUTIN.

The problem of the self-excitation of an alternator is of but little moment so long as it is a question of important central stations, it being fully recognized in such cases that the simplest and most rational solution is to have the alternators separately excited by one or more independent machines.

This is no longer the case, however, as we shall show when it comes to installing apparatus in a private plant of moderate size. In such an event the material must be as simple and strong as possible, for the operation and maintenance of the apparatus is often confided to the care of persons with limited experience. In most plants of the above nature direct current alone is generated and this can be readily explained when it is remembered that alternators require to be excited either by means of a small direct-current machine or by the use of a special

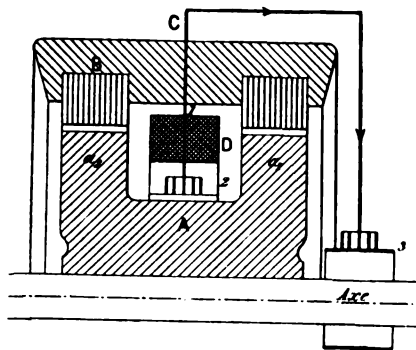
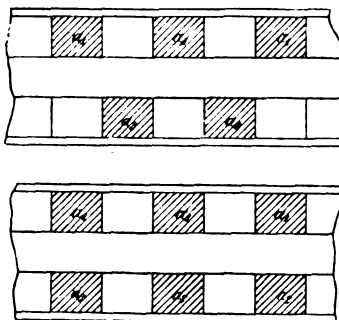


FIG. 1.

commutator, and as there is no material gain in power or saving in price they have no very marked advantage over direct-current machines.

In spite of all the improvements that have been added to it, the direct-current generator, which at the present time is considered to have reached a high state of perfection, necessarily requires for its operation delicate attachments, the satisfactory operation of which depends on constant and careful supervision. Unquestionably in large central stations, where expert electricians are in charge, the proper maintenance of the commutators presents no serious difficulty, but on the other hand it is equally acknowledged that it is always due to the deterioration of this very part that dynamos that have little care given them ultimately fail. This is what often occurs with machines in private plants.

The above considerations led me to seek to discover a generator capable of operating without the help



FIGS. 2 AND 3.

either directly or indirectly of a rectifying commutator.

The solution which I sought applies to alternators of the type known as unipolar. Let A, Fig. 1, be the magnet and B the armature, the latter can be provided, as is well known, either with a single coil or two distinct coils, according to whether the pole pieces a_1 are situated opposite the spaces which separate the pieces a_2 , or opposite the pieces themselves. These two positions are shown in Figs. 2 and 3.

However this may be arranged, if we suppose a

* Translated from *L'Eclairage Electrique*, Paris, for *ELECTRICITY*.

conductor C placed in the massive section of the armature, as is shown in Fig. 1, it will readily be seen that there will be developed therein an electromotive force capable of generating a continuous current.

Calling θ the total flux through the core A, and n the number of revolutions per minute, the value of e in volts can be determined by the formula—

$$e = \frac{n}{t} \theta 10^{-8}$$

It is this electromotive force that I make use of for the self-excitation of the alternator. To accomplish this it suffices to connect the extremity 1 of C to one end of the coil D (assumed stationary) and to complete the circuit as shown in Fig. 1 by means of the contact rings 2 and 3 (electrically connected either through the mass or by means of a special conductor). It is true the difference of potential obtained is scarcely more than a few volts with machines of moderate power, but this is no serious detriment, for the weight of copper necessary to excite any machine, as can be readily shown, is absolutely independent of the voltage utilized.

In actual practice it may be found necessary to employ several conductors similar to C, connected in parallel. The exciting coil, moreover, carrying several circuits, could be so arranged as to aid a multiple contact interrupter; the tension could therefore easily be regulated by means of a rheostat placed on a single one of these circuits, and large variations could be controlled by moving the interrupter previously mentioned.

Through the courtesy of MM. Brown, Boveri & Cie. and the directors of the shops of Oerlikon, I have been able to make a few experiments to determine what results could be obtained with an alternator excited in the way I have just mentioned. I have ascertained that the increase of voltage with full load excitation is but a small percentage over that at no load excitation.

At the Oerlikon works this self-exciting method was applied to the ordinary type of generator manufactured by that firm. The copper ring 2 was done away with and the interior brush rubbed directly against the core A; notwithstanding this it was possible to obtain a current amply sufficient for self-excitation as is shown in the following table.

The first column gives the speed of the alternator in revolutions per minute, the second gives the number of ampere turns at normal excitation, and the third and fourth give the limit of voltage of C and the intensity of current on the unipolar circuit in which a rheostat was located.

THREE-PHASE GENERATOR WITH 2 x 4 POLES.
Normal speed 450 revolutions, 950 volts, 30 alternations.

Revolutions.	Ampere-turns.	Voltage.	Intensity of current for self-excitation.
415	480 x 7	1	0
415	480 x 12	1.8	0
415	480 x 18.5	2.5	0
415	480 x 25.5	3.1	0
415	480 x 18	1.9	204
403	480 x 26	2.6	420
405	480 x 24	2.4	420

Resistance of exciting coil, 2 ohms.
Maximum exciting current, 25 amperes.

Admitting as correct the value of density and speed at the points of contact of the brushes with the rings—the figures being determined with the Siemens generators with outside collector rings—we find that with the generator on which we experimented three brushes of 3 cm. by 1 cm. would be ample and that the speed could attain 575 revolutions.

It is only proper in closing to state that this arrangement could be advantageously applied in the construction of small synchronous motors as well as to transformers destined to be used for electro-chemical purposes.

THE MIDLAND RAILWAY'S ELECTRIC LIGHTING PLANT AT LEICESTER.*

When Mr. W. Langdon in 1895 read his valuable paper on "The Employment of the Electric Light for Railway Purposes," the plant at Leicester had not long been running, and hence the figures of cost of working could not be given. Now that the plant has been at work for some few years, a *resumé* of the results achieved will be of interest to our readers. During the intervening period many improvements have been made to the various engines, machines, and other apparatus used, and the plant generally has been subjected to more than the renewals usually allowed for in central-station work. Thus the figures for repairs and wages are higher for the time being than would be found if a obseese paring policy were adopted. Mr. Langdon believes in the best machinery and treating it in the best possible way, and hence the electric lighting stations of the Midland Railway Company are models of their kind.

The site available for the station was limited in extent, and this influenced the arrangements. In fact, due to the increase of the incandescent lighting, a portion of the space which has to be used for the men's quarters had at the last moment to be thrown into the engine-room. The lights supplied from the station include the following: 113 series arc lamps, taking 10 amperes each; 23 arc lamps, supplied in parallel circuits of two lamps in series; 11 32-c. p. incandescent lamps, 189 16 c. p. lamps and 120 8-c.p. Thus the series lighting corresponds to a load of 57 kw. and the parallel lighting to about 30 kw.

The series arc lighting is supplied from three Brush arc lighters of the old open-coil type. The regulation of the voltage of these machines, each of which is capable of taking 50 arc lamps, is effected in the usual way by carbon rheostats and relays. The most noticeable part of the arc lighting gear is the switchboard, which was designed by Mr. Langdon's staff and manufactured in the Midland Company's shop. With this board the use of flexible cords and plugs is avoided, and the face of the board at any time indicates in diagram the circuit arrangements. Thus the circuits are so arranged that whole platforms can be switched on or off from the engine-room. In this way the lamps are run on some seven different circuits, having from nine to thirty lamps each, which are grouped together at the board as may be required. The latter is composed of 12 panels. The panels are of slate, mounted in a wooden frame. There is in the center of each panel a horizontal metallic axis, on which swivel eight sockets, all connected together. Into these sockets loose switch bars with handles are placed, which make connection with either jaw in the two rows of eight jaws at the top and bottom of the panel. Seven of the panels have the central axis connected to circuit positives, three are connected to dynamo negatives, and the other two with voltmeter terminals. The contact jaws at the top of the panels are positives, and the lower jaws are circuit negatives. Thus in building up a number of circuits on to one machine, a switch bar is inserted in the swivel plug of, say, circuit positive No. 1, which is opposite to the jaw connected to, say, dynamo positive No. 2. Then if No. 3 arc circuit is wanted next in the series its positive is switched on to the negative of No. 1 at the third panel. Finally, after perhaps another circuit has been added, the negative panel of dynamo No. 2 is used to switch on to the negative of the last circuit. With this system of connection it is easy to cut out any arc circuit from a series by short-circuiting it, and it does not matter at which part of the series the circuit happens to be. Over these switch panels are placed circuit current indicators, to show automatically which way the current is flowing. Over these again comes the three ammeters placed in the dynamo circuits. The whole of the metal parts of this switchboard are encased with

ebonite, except at the contact surfaces, so that it is not dangerous to the operators.

The parallel lighting plant consists of a Brush two-pole direct-current dynamo giving 290 amperes at 115 volts when running at 800 revolutions per minute. This is driven from the same sized gas-engine as is used to drive the arc lighters. Besides this machine, there are two Siemens dynamos, each capable of giving 125 amperes at 115 volts when driven at 600 revolutions. Two smaller gas engines are used to drive these two machines. There is nothing special to note in the switchboard for this part of the station, but the compensator placed in the feeders needs special reference. This compensator was designed by Mr. W. B. Sayers, and manufactured by Messrs. Mavor & Coulson of Glasgow. It consists of a generator and motor mounted on the same shaft, but on separate cores, to allow of the fields being separately excited. The motor is shunt wound for running at constant speed on the 110-volt circuit, while the generator is series wound. The design of this latter machine is so arranged that the voltage is increased in direct proportion to the current flowing in the circuit. This little dynamo is wound for a maximum of 150 amperes, and then generates 10 volts. It runs at a speed of about 1,080 revolutions per minute. Previous to its use trouble was found with the arc lamps used in parallel off the low tension mains, as they were apt to hunt. Now the voltage at the further end of the line is kept constant independent of the load.

The engines were all supplied by Messrs. Crossley Bros., and are of their special high-speed electric lighting type. The engines driving the arc lighters and the larger low-tension dynamos are each capable of developing 50 H.P., using Dowson gas, and running at 200 revolutions per minute. The engines have cylinders 16 in. in diameter and a 21 in. stroke. As there are no batteries as a stand-by, it is essential that the engines shall be capable of running continuously. Hence an efficient arrangement of oiling has been devised, and added to the engines since their erection. The crank pin is oiled by means of a centrifugal oil shield attached to the crank. A sight-feed lubricator drops oil into this, which then flows up into the crank-pin bearing. In this way very prolonged runs in time of fog have been made. The system of oil catching has also received special attention. The first foundations of the engines suffered from the oil running down and rotting the concrete. This necessitated the renewal of the foundations, which are now covered with sheets of lead, in which channels are arranged to conduct the waste oil away into suitable receptacles.

Since the engines were first laid down, counter-weights on the cranks have been added by the Midland Railway Company, which have much improved the steadiness of the running of the engines. These counter-weights were fixed on in the company's shops and the method of strapping them on by rectangular iron bands is particularly neat. The ignition in these engines is by means of tubes, both iron and porcelain having been tried. We understand that the porcelain tubes are found to give satisfaction if due care is taken of them. The heating of these ignition tubes is done by town gas. The engines can be run by either Dowson or town gas, and the admission valves and pipes are so arranged that the change over from one to the other can be quickly made. This would seem at first sight to be a great essential, as the gasholder used for the power gas would not run the full load for many minutes if a breakdown in the generators occurred. Mr. Walter C. Goodchild, the resident engineer, informs us, however, that such breakdowns do not occur in practice. The town gas stand-by is hence rather an expensive luxury, as a minimum consumption of 1,500,000 cubic feet of gas per annum had to be guaranteed before the Corporation laid down the necessary mains. Before leaving this part of our subject, we cannot help referring to the painting of the engines. This has been done again, and each

engine is ornamented by the coat-of-arms of the Midland Railway Company.

At Leicester there are now installed two complete sets of Dowson generators and boilers, each capable of developing gas for 100 H.P. at the engine. Each set has its own gas-cooler, hydraulic box, coke-scrubber and sawdust-scrubber. The boilers are not both used at the same time, as one will supply sufficient steam for both generators. As regards the working of the apparatus, we may state briefly, for the benefit of our younger readers, that the generators consist of a closed cylinder with firebars a few inches from the bottom. The fire is of anthracite coal, and the jet of steam and air under the bars regulates the production of power gas. The partial combustion only and the decomposition of the steam results in the generation of a considerable proportion of carbon monoxide, from which power is obtained in the explosion. This is the rough idea, but in the detailed working of such a plant great care is needed to ascertain the best method of working to produce uniform and good gas.

It is to the determination of the best method of working these generators that Mr. Goodchild, the resident engineer, has devoted special attention. The results he has achieved can be best seen from the following figures: The total cost per unit for the half-year ending December, 1895, was 3.30d., and in this period 4.6 lb. of coal were consumed in the generator for every Board of Trade unit developed by the dynamos. For the first half year of 1896 the cost per unit was 3.09d., and the pounds of coal per unit 3.66. Finally, for the first half of 1897 the cost per unit was further reduced to 2.8d., and the coal per unit to 3.03 lb. From these figures it will be seen that the coal required has been reduced from 4.6 lb. to 3.03 lb., or by 34 per cent. This reduction has largely been effected by the use of a cheaper class of coal. Up to July, 1896, both the generators were worked with ordinary anthracite coal. At that date one of the generators was altered to use machine-washed anthracite peas, which cost 5s. to 9s. at the pit's mouth. After adjusting the working arrangements, it was found that 25 per cent. better gas could be obtained with the small coal. With the ordinary anthracite a fire about 4 ft. deep was used in the generator, whereas with the machine-washed peas 18 in. of fire gave best results.

The better results obtained are said to be due to a greater uniformity in the fire itself. With the large coal and the cup and cone method of charging, the larger pieces get to the outside and allow a certain proportion of steam and air to get through unaffected. With the small coal the grate area has been reduced to 2 ft. 6 in., while the lining of the generator is 3 ft. The second generator was converted to use the peas soon after the improvements in the quality of gas had been established. The advantages of the small coal may be summed up as follows: First, 25 per cent. better gas, enabling the 100 H.P. furnace to develop 120 H.P. to 130 H.P.; second, a more even quality of gas; third, the reduction in the cost of fuel; and lastly, the fact that the generator can be started up in much less time. It is usually found that in 10 minutes good gas is obtained.

The complete figures as to the cost of working at Leicester for the half year ending June 30, 1897, are as follows. The second column, headed 1896, gives the corresponding figures for the first half of that year:

	1896.	1897.
Arc lamps in use.....	137	141
Incandescents.....	288	320
Total units.....	126,514	137,070
Total cost.....	£1,631 9s. 1d.	£1,601 15s. 9d.
Total cost per unit.....	8.09d.	2.8d.
Labor per unit.....	1.42d.	1.49d.
Stores and carbons.....	1.19d.	.86d.
Repairs.....	.13d.	.16d.
Coal.....	.32d.	.18d.

For the same half-year in 1897 the cost per unit generated by town gas was 1.42d. For comparison with a steam plant the figures obtained from Derby for the same half-year are as follows: Total cost,

*From the *Electrical Engineer*, London.

2.7d. per unit; coal, .38d. At Derby, however, there are no arc lamps to be trimmed, which saves considerable in the labor item. At Sheffield the figures are 2.64d. per unit for total cost and .54d. for coal.

It is interesting to note that if the Leicester installation had been worked without any town gas being used, the average cost per unit would be reduced to 2.67d. This figure is easily ascertained from the quantity of town gas actually burned during the half-year, and the corresponding cost of anthracite peas to produce the same power.

In conclusion, we have to express our thanks to Mr. W. Langdon for his courtesy in placing these figures at our disposal, and for kindly allowing us to inspect the works. We also have to thank Mr. Goodchild for explaining the various steps which have been made in perfecting the plant.

TRAMWAY POWER FROM LIGHTING STATIONS—WHAT IS A FAIR PRICE TO CHARGE?*

The present seems an opportune time for bringing to a point the discussion which has for some time been carried on regarding the question of what is a fair price to charge for electricity for tramway purposes when the power is generated by a lighting company or by a local authority at their lighting station. The divergence of view between the electricity seller and the electricity user is wide. We shall here attempt to bring out the issue by giving a statement of views on each side. Of course, the subject can only be dealt with generally, because every district of the country—one might almost say every separate town—presents its own local conditions and peculiarities which have their effect on prices. The situation which has led to the discussion is briefly this. In some towns the local authorities who run electric lighting stations have refused to consent to tramway companies adopting electric traction unless the companies buy the current from the local authorities, and, of course, pay the price which the sellers demand. In other cases there may be circumstances which render it advisable for the tramway companies to buy power from the local authorities or lighting companies, instead of generating current themselves. The owners of the lighting stations say they cannot afford to sell the current at less than a certain rate; the tramway companies maintain that it can profitably be sold at a much cheaper rate, and that if the higher price is insisted upon they simply cannot afford to use electricity. This is the situation, and as there has been comparatively little practical experience as yet in this country of the cost of generating electricity for tramway purposes there is some room for uncertainty. In fact, so far as published accounts go, there is nothing to show what is the cost per Board of Trade unit of generating current for traction.

We shall first give a statement of the case from the point of view of the seller—that is, the local authority or the electric lighting company. The accounts of these bodies show a wide divergence in the cost (per unit sold) of producing current, varying with the locality and the amount produced. Of four local authorities selling more than a million units per annum, the average cost is 1.63 pence; of four selling between half a million and a million units, the cost is 1.95 pence. At the other end of the scale, of twenty selling less than 200,000 units each, the average cost is 3.51 pence. Among companies one sells more than a million units annually, and the cost of production is 2.44 pence. Three sell between half a million and a million units annually, and the average cost is 2.28 pence. Omitting as before the medium quantities, we may jump to twelve companies selling less than 200,000 units each, and here the average cost is 4.26 pence. All these cases ex-

clude the Metropolitan area where the price of labor and in fact of most things is very high.

Taking up now the statement made to us the other day by the manager of a large electric lighting company, he points out that even in several towns on the Continent where more than a million and a half units are sold annually, the price charged is about 1½d. per unit. He thinks it could not possibly be less, and lays stress on the contention that with a tramway plant the load factor in proportion to the total capacity is as a rule not more than 50 per cent. When a plant is running at half load (on the average) the steam consumption is much greater in proportion than if the plant were fully loaded. With a lighting plant the average load factor is much higher and therefore the economy is greater. Then for tramway work it is wise to have a large reserve of power standing idle so as to provide for extra traffic and breakdowns. If half of the plant is in reserve as a rule, then the load factor on the whole machinery in working order may be only 25 per cent. Yet enough revenue has to be got to pay the interest on the whole plant, without saying anything of profits. On the other hand in a lighting station, taking load to plant capacity running, it is not impossible, nor even uncommon, to get 80 per cent. utilized. Besides these things, and partly dependent upon them, is the fact that the load on a lighting station is not subject to such rapid and frequent enormous changes as that on a tramway power station. In the latter case the load often jumps from almost zero to a few hundred amperes in a moment, or vice versa. This is very trying on the plant, and it is a trial to which lighting stations are little subject.

In the case of a lighting company or local authority providing current to a tramway company, the items actually chargeable to the traction plant would be coal, oil, and say, three additional men's wages. The lighting station superintendent would also superintend the traction plant. As to capital, special traction dynamos and engines and additional boilers would be necessary. Upon these interest and depreciation would have to be allowed. To meet all these things the charge for current sold to the tramway company, if the quantity sold was less than 100,000 units per annum, would have to be at least fourpence per unit. If larger quantities were sold, the cost per unit would be less. In the Midlands, with coal at the door, a million units per annum for traction purposes might be sold at 1½d. per unit, but in other parts of the country it could not be done for less than 2d. As to the possibility of dynamos and a system of circuits being devised which would serve for both lighting and traction, our informant thinks it probable something of the kind will be done in the future, so as to keep down capital expenditure and give a better load factor all over the plant. Perhaps some development of the three-wire system now coming into use for electric lighting may solve this point. At present, with a 220-volt pressure, double that difference of potential can be got on the three-wire system between the two "outside" wires when the two dynamos are coupled up in series. A potential of 440 volts approximates to some extent to the 500 used for tramway purposes. Thus far the statement from the sellers' point of view.

Next we give some arguments from the buyers' standpoint, as communicated by the management of a prominent traction company. The main feature is that the cost of electricity is not determined by the quantity produced but by the period of time per day during which it is used. While it is true that when machinery is running it is very much cheaper per unit to produce a larger than a smaller quantity, it must be borne in mind that if the machinery is not utilized to the fullest extent every unit obtained costs more than if the machinery is constantly and fully employed. For example, if the plant is fairly well loaded, for say, sixteen hours a day, as when used for tramway purposes, it is much more economically employed than if only loaded three or four

hours a day, as for lighting purposes alone. Apart from the question of men's wages and paying men to stand by in winter to have everything ready for a fog, it can be seen that the few hours' lighting per day have to bear the interest on the capital and all the management expenses. This, our informants insist, is a most important point, and its value will readily be recognized.

To take one case in illustration. In Brighton the ordinary consumer of current for lighting purposes is charged 7d. per unit for the first hour's lighting, but if he uses his lamps for more than one hour per day the charge for the subsequent hours is only 1½d. per unit. Thus for two hours' supply the charge is 4½d. per unit. If the consumer uses the electric current for sixteen hours a day (as a tramway company would), he pays 7d. per unit for the first hour, and fifteen times 1½d. for the rest of the time, or 22½d. for the whole period. (Readers need hardly be reminded that the unit includes a time element, seeing that it is 1,000 watt-hours). The charge then for the whole sixteen hours is only 1.8 pence per unit. The Brighton Town Council herein recognize the importance of having a load distributed over a long period of the day (or night), and give this great encouragement to the consumer, no matter on how small a scale may be his demands. The lesson drawn is that even more favorable treatment can safely be conceded when dealing with a tramway company who want current for at least sixteen hours per day, and who will require perhaps half or two-thirds of the total load on the electricity supply station. Having such a large customer, the local authority or lighting company can well afford to put down special plant, and can have cheaper arrangements (proportionally) for the staff running the station. Consequently, special terms should be granted to such a large customer—a customer before whom all others individually pale into insignificance. The Brighton system of charging for light requires a special instrument to record the duration of use, and this was devised by Mr. Arthur Wright, engineer to the Corporation. The wisdom of the system is shown by the fact that it has been adopted in many towns all over the country.

In Mr. E. Garcke's "Manual of Electrical Undertakings" for 1897 we notice that some reference is made to this subject, and the point is emphasized that the cost of supplying electricity depends more upon the rate of supply than upon the quantity supplied. The great bulk of the expense is governed by the maximum demand.

To return to our informants, they insist that another very important point is that in a lighting station the charges made to the public and the costs of production given are calculated on every unit actually supplied to the lamps. The total amount so supplied is considerably less than that produced in the stations, because there is a great loss in distribution and because there is as a rule a quite appreciable proportion of the total output consumed in lighting the station itself and the premises connected with it. This fact is very apt to be overlooked. The result is that both the charge to the consumer and the cost of production returned are materially higher per unit than they would be if every unit generated were sold. The local authority or lighting company cannot charge the consumers for every unit generated; the charge is for every unit consumed by the customer as registered by the meter on his own premises. But if a tramway company takes current from a lighting station the case is quite different. The tramway company buys the current at the producing station, as measured by the station instruments at the point of exit, and therefore pays a great deal more than if it were to pay at the same price per unit for the current actually taken by the cars.

In this connection we have looked up the accounts of a large number of lighting stations, and find that the percentage of current actually sold to current generated varies from 61 to 98. The latter figure is

* From the *Railway World*, London.

quite exceptional, and the average may roughly be taken at from 75 to 80 per cent. Apart, therefore, from any other consideration whatsoever, the tramway company should have a reduction on the ordinary charges of at least 20 per cent.

Regarding possible improvements or modifications of electric lighting dynamos and circuits, our informants say that it will always be necessary to have separate generators for tramway purposes in order that the records insisted upon by the Board of Trade as to insulation, drop in potential, etc., may be kept.

Having concluded the statement of the two views of the case, one other point—it is not a very large one but it is cumulative—should be mentioned. The owners of lighting stations have to supply, lay and maintain their own mains, and this cost is part of the "cost of production per unit sold." But a tramway company would provide and maintain their own conductors and feeders from the switchboard all over their lines.

Doubtless the above considerations are not exhaustive on either side. So far as they go, however, the bulk of proof seems to rest with the tramway companies. There can be no doubt about the fact that we have not yet seen the end of possible economies in the production of electricity when on a large scale, and when spread over the greater part of the twenty-four hours. A recent example from America will illustrate the point. On the tramway system of Brooklyn, amounting to 254 miles of track, the cost of power during the year ended June 30 last was only a shade over one halfpenny per car mile. Per unit it was a little over one farthing, and in the Kent Avenue station of the company (where 15,000 horse-power is installed) the cost per unit was just a shade above a farthing. The items included in the cost are fuel and supplies, labor and repairs. The corresponding items "per unit sold" at lighting stations in this country vary from one penny upwards, and the average may be put at about twopence. In this country it may be taken that on the whole the amount of current required per car mile is from .7 to .8 of a unit, against one unit or more in America. The difference is largely due to the fact that in the United States the demand for high average speed leads to very sudden startings after the stoppages, which consume an inordinate amount of current. On the question of quantity of current required, therefore, existing lighting stations need not be troubled. Take a town of moderate size with ten miles of double track or its equivalent in double and single. A mileage of 300 car miles per mile of double track per day is not extravagant. This is 3,000 car miles per day, or, in round figures, over a million car miles per annum. At .75 of a unit per car mile we get three quarters of a million units per annum. The calculation need not be applied to the large cities, because there the tramway companies or local authorities will no doubt produce the current independently of any lighting stations. On the whole there seems to be good ground for contending that in the neighborhood of coalfields at all events the charge for power by lighting stations should not exceed three halfpence per unit, and should in many cases be considerably below that figure.

Electrical Activity in Texas.

A meeting of the executive committees of the Texas Gas & Electric Light Association and the Texas Street Railway Association was held at Austin, Texas, on January 16. Mr. L. T. Fuller presided. After some discussion it was decided to hold a joint meeting of both Associations at Laredo, Texas, on March 9, 10, 11 and 12, 1898; to extend an invitation to the gas and electric street railway and power men of Mexico, and to devote a part of the programme to papers prepared by the latter.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

LONDON NOTES.

[From our London Correspondent.]

Telegraph Rates from Europe to Jamaica.

By an arrangement arrived at by the West India & Panama and associated English telegraph companies a large reduction in telegraph rates between Europe and Jamaica came into force on January 1. The rate hitherto has been 5s. 10d., but it is now 3s. per word—a reduction of 2s. 10d. This reduction is to be extended to the West India & Panama Company's stations east of Jamaica, and will also include Demerara.

Principles of the Electric Telegraph.

Prof. Oliver Lodge has just been delivering a course of six lectures adapted to a juvenile auditory at the Royal Institution of Great Britain. He divided his subject off into the following sections: (1) The production of an electric current; (2) detection of an electric current; (3) land telegraphy; (4) ocean telegraphy; (5) principles of wire and cable signaling; (6) space telegraphy. The lectures being specially prepared for young people were of course very elementary and the many experiments shown were on the same lines. As usual with the Christmas lectures at the Royal Institution, large audiences have been in attendance. The chief interest undoubtedly centered around the concluding lecture on Saturday, January 8, when "Wireless Telegraphy" was the subject. Dr. Lodge has done a good deal in this direction. An outline of his lecture gives these points: Ancient methods of signaling through space, followed by comments dealing with electric methods. Electric wireless telegraphy depends on the emission into space of a wave or pulse equally electric and magnetic. A wire could guide this impulse to a destination, but without a wire it spreads like sound. The lecturer next dealt with telegraphy by magnetic impulse alone, detected by induced currents, and best directed by iron; telegraphy by electric impulse alone, detected by electroscopes, and best detected by copper; telegraphy by electro-magnetic impulse, a true and simple wave of the electric and magnetic energies are equal, with a definite velocity; production of electro-magnetic waves: Henry, Helmholtz, Lord Kelvin, Feddersen showed that a Leyden discharge was oscillatory, Clerk Maxwell, FitzGerald and Hertz showed that such oscillations emitted waves; detection of electro-magnetic waves at a distance: by Hertz, Branly and by many other experimenters; recent attempted application of the waves and their detectors to actual business telegraphy; meaning of electric resonance, or *syntony*, and absence of it from the practical attempts so far made and published; mode by which it may be attained; syntonic telegraphy; electro-magnetic waves and detectors for them are also in reality very ancient; the sun or a candle is an emitter, the eye or a photograph plate is a detector; in other words, ordinary light consists of a succession of true waves, with equal electric and magnetic energies, traveling in the ether at the speed of a pure and simple telegraphic signal.

Underground Electric Railways for London.

The construction of the underground works in connection with the several railway lines beneath the city of London is making good progress, and it is expected that before many weeks have passed one of the lines—the Waterloo & City line—will be on the verge of completion. The tunneling operations for the Central London line and the extension of the City & South London line are making headway, but no idea can be given as to when these lines will be ready for running. There are so many schemes and proposals on foot of this character that one is likely to be bewildered. In a few years underground London will be quite a network of electric railways. Two new schemes of which official notice has lately been given are the New Cross & Waterloo line and the Charing Cross & Paddington Electric Railway.

The Charing Cross line will commence at Northumberland avenue and terminate near the present Paddington station of the Great Western Railway. The new line will be connected with the Paddington station of the Great Western Railway by means of a subway. The capital of this scheme is somewhere about seven or eight million dollars divided into \$50 shares, and there will be from two to three millions in debenture stock. The line is to be completed within five years, during which time interest is to be paid out of the capital. The New Cross proposal, for which a private bill has been deposited, provides for the construction of an underground line from Old Kent Road, close to the London, Brighton & South Coast Railway, to Waterloo Road near the South Eastern Railway. The total length of the line will be a furlong or so over three miles and the work is to be completed within five years. The capital of the undertaking would be about four or five million dollars, with about one and a half million dollars in debenture stock.

London's Maximum Current Demand.

It appears that great difficulty is experienced by electric lighting companies and local authorities who supply electricity in London in providing sufficient energy to enable them to meet the demands of consumers at certain times of the day, while the production by each separate company and local authority of sufficient energy to meet the maximum demands involves the expenditure of large sums of practically unproductive capital, and results in the consequent increase in price that has to be paid for the current. It is proposed to overcome these difficulties by a company which seeks power from Parliament to erect generating stations on one central spot in Marylebone, on the banks of the Regent's canal, and from this point to supply electrical energy in bulk to any company, body or person at arranged terms.

YOU CAN'T STOP 'EM.

The Fury of an Unfettered Element Fails to Crush Them—The Fire Fiend Defied.

The news comes from Attica, Ind., of the destruction by fire of the big laboratory and office building of the Sterling Remedy Company, makers of Cascarets Candy Cathartic and No-To-Bac, the original guaranteed tobacco habit cure. The preparations made by this big corporation are known throughout the world, and disaster came like a bolt out of a clear sky.

The fire broke out in one of the packing rooms on the third floor during the noon hour, and had made considerable headway before it was discovered. The primary cause was a defective flue through which the fire was communicated to a big pile of packers made to contain the "Pyramid of Health" standers so familiar to all on the retail druggists' counter.

As soon as it became apparent that the fire department would have difficulty in combating the flames, the work of saving the thousands of valuable documents, contracts, files, millions of booklets and tons of advertising matter was begun with the utmost energy. The Sterling Remedy Company is the principal industry of the beautiful little city of Attica, employing several hundred people, besides being affiliated with the interests of the Indiana Mineral Springs, the famous Magno-Mud Cure. The entire population was worked up to a frenzy of excitement and hundreds of men, women and children vied with each other in carrying the contents of the burning building to places of safety.

The entire neighborhood was covered with scattered heaps of printed matter, letters, furniture, Cascarets and No To-Bac, in interminable confusion, while the firemen struggled with the fire.

Meanwhile the almost proverbial energy and presence-of-mind of "Hustling" Harry Kramer, the general manager of the Sterling Remedy Company, was displayed. He was the coolest man at the scene, and while the destruction was going on was forming

lating a plan for continuing the business without interruption. He quietly walked away, and secured a big carriage show room near by, and had all office furniture, charred and dilapidated as it was, taken there. Before the boxes had ceased burning in which the fire originated, orders were being dictated in the make-shift office for new supplies, and car loads of material were ordered by wire while the streams were playing on the ruins. Several shipments were made the same evening from goods saved, and on Friday morning all departments were at work in various rooms about town, while a gang of men were clearing away the wreckage preliminary to rebuilding.

The actual damage amounts to many thousands of dollars; the loss due to interruption of business and confusion of detail is inestimable, but pluck and energy of one man will turn defeat into victory and move the wheels of business to ever-increasing speed. Nothing can stop the success of Cascarets and No-To-Bac with such characteristic force behind them.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

GENERAL NEWS.

What Is Going On in the Electrical World.

Akron, O.—George W. Crouse, one of the receivers appointed for the Akron Street Railway & Illuminating Company, has stated that the company would soon be reorganized, and that the bond issue, the interest on which was defaulted, would be decreased.

Amsterdam, N. Y.—A. Jay Devendorf and Henry A. Devendorf have entered into an agreement with the Amsterdam Street Railroad Company, the Amsterdam Arc Light Company and the Edison Electric Light & Power Company to furnish hydraulic power for fifteen years, beginning soon after April 1. The plant will be located on Schoharie Creek near Mill Point.

Atlanta, Ga.—A company of New York and Pennsylvania capitalists has acquired control of the Chattahoochee river from Jones' Shoals to Power's Ferry, and have taken options on land valued at \$175,000, including three shoals capable of developing 11,000 horsepower. The projectors have secured all the options they need and under legislation enacted at the recent session of the General Assembly are given power to condemn property needed for the development of the water power in the same way that property is condemned for railroad purposes. Col. H. H. Berry, of Gainesville, a prominent lawyer, representing the capitalists, has filed in Fulton Superior Court an application for a charter for the Atlanta Water Power Company, and their agent, Colonel Cook, an English engineer, is expected to arrive here soon to begin active work on the development of the water power.

Chicago.—President Louderback of the Lake Street Elevated Railroad Company is quoted as authority for the announcement that the suburban trains of the Chicago, Milwaukee & St. Paul Railroad will soon be operated by electricity instead of steam, and that already contracts for furnishing electric power for the trains had been entered into with the North Chicago and West Chicago Street Railroad Companies.

Charleston, S. C.—A bill has been presented in the Legislature at Columbia to incorporate the Charleston & Seashore Railroad Company, whose object is to build and maintain an electric road in Christ Church Parish, Sullivan's Island and Long Island, to the ocean. The incorporators are J. S. Lawrence, Philip H. Gadsden, W. W. Lawton and their associates. The bill empowers the company to manufacture, produce, generate and supply light, power or heat, not only for the purposes of the said railway, but for sale to the general public. The capital stock is placed at \$500,000.

Cincinnati, O.—The Bullock Electric Manufacturing Company is said to have fixed upon a site at Norwood, a suburb of Cincinnati, for its new works, and at a cost of \$100,000 will build there, the "Enquirer" says, "one of the most attractive and modernly arranged manufacturing establishments in Cincinnati." When the new works are completed 300 men will be employed.

Cleveland, O.—The largest armature for the largest generator of electricity ever made in the world for a trolley railroad has been completed in Cleveland, and shipped from the works of the Walker Company for Brooklyn, N. Y. The whole generator when assembled will be twenty feet high, twenty feet long and fifteen wide. It is the first of a pair of such monsters being made by the Walker Company for the Brooklyn Heights Street Railway Company. The armature weighs 99,000 pounds. It is 7½ feet wide and 10 feet high.

Denver, Col.—Neil McDonald of New York, a prominent railroad promoter and builder, was a recent visitor in Denver, the object of his visit being, it is understood, to consult with interested parties in regard

to a proposition to build an electric line from Denver to Boulder.

Dolgeville, N. Y.—The formal opening of the generating plant of the Dolgeville Electric Light & Power Company was celebrated in this village on the 15th inst. The village was dressed in holiday attire in honor of the occasion, nearly all of the business places and many of the private residences being decked with flags and bunting. A large number of distinguished visitors from all parts of the State had been invited and most of these were present, among them Lieut. Governor Woodruff, who was selected to start the machinery. In the evening a banquet was provided in the Turn Hall, which was splendidly illuminated with electric lights. Several good speeches were made and Alfred Dolge, the enterprising head of the company, delivered an address in which he dwelt upon the rapid growth of the village and pointed out its availabilities as a manufacturing center.

Fort Wayne, Ind.—The Ft. Wayne Electric Corporation has recently equipped its polishing room with an apparatus for purifying the atmosphere of the room by carrying all sand or small particles of metal loosened by the polishing machines into tanks on the outside of the building. The apparatus consists of a series of pipes leading from the machines to a large drum in which an exhaust fan revolves at the rate of about 1,600 revolutions a minute. The draught caused is strong enough to remove the dust of the machines and will prevent much sickness caused by the men having to inhale this dust.

Guthrie, Ok.—The Guthrie electric light plant has been sold to J. W. Bedle of Lacey, Minn., and J. O. Severns of this city. The plant is valued at \$30,000.

Houston, Tex.—Blake Dupree, receiver of the Citizens' Electric Light Company of Houston, has filed his bond with the clerk of the United States Court in the sum of \$10,000 and taken possession of the property.

Joliet, Ill.—By unanimous vote of the city council the Joliet City Railway Company has been given a franchise for fifty years and several miles more of streets. The company has \$500,000 invested, and will put \$200,000 more in this winter. This is the first franchise granted under the Allen law, which was passed at the last regular session of the Legislature. The public in general are in favor of the franchise granted.

Milwaukee, Wis.—The "Sentinel" says: "The General Electric Company is reported to have an alliance with the E. P. Allis Company of this city to furnish electric equipments for large plants in all parts of the world. The Allis Company furnishes the engines, while the electric company furnishes generators. Equipment is now being furnished for the cities of Dublin, Madrid and other European towns."

New Orleans.—The directors of the Orleans & Jefferson Railroad Company have abandoned their original intention of using compressed air as motive power for the road and decided to adopt electricity. They have closed a contract with J. W. Coffin of New York for the entire construction of the road and its equipment with the trolley system.

New York.—The purchase of a controlling interest in the Union Railway Company ("Huckleberry Road") by the Third Avenue Railroad Company greatly widens the field of its operations. The Union Company has at present single and double tracks laid in thirty-seven miles of streets, and has franchises for fifty-four miles of streets in the district north of the Harlem River. The company's statement for the year ending June 30 last showed that it earned \$86,391 over and above all fixed charges and taxes.

New Haven, Conn.—A dispatch from Torrington to the "Leader" states that Capt. J. M. Murphy, inventor of the "Safety Third Rail Electric System," has made arrangements with a manufacturing firm at Torrington for the construction of a complete model of his system which is to be sent to London for examination by some railroad magnates. The dispatch adds that "a construction company has been organized, with two millions capital and Henry Villard, formerly of the Northern Pacific, as president. The switches are so far made in New York, but Capt. Murphy has not yet given up his hopes of the concern deciding upon Torrington if proper inducement is made."

Owego, N. Y.—The Decker-Hinckley Electrical Manufacturing Company's manufactory is fast nearing completion in this village and promises to be one of the most completely equipped establishments in this section of the State. The company will make a specialty of an automatic switchboard which Mr. Decker has patented in this country and abroad. The members of the company are Ward Decker and Edward J. Hinckley.

Peoria, Ill.—The stockholders of the Peoria & Pekin Traction Company have voted to increase the capital stock of the company from \$300,000 to \$500,000. They also voted to issue bonds to the amount of the stock, the bonds to be for \$1,000 each.

Reading, Pa.—There is now a strong probability that the electric railway between this city and Boyertown will be built. The right of way has all been secured, and it is stated on good authority that New York and Philadelphia parties are ready to buy the franchise and construct the road.

Schenectady, N. Y.—The General Electric Company is preparing plans for a large iron foundry to be located in this city. The officials of the company also announce that they are considering the advisability of removing the lamp works now located at Harrison, N. J., to Schenectady.

Schoolcraft, Mich.—The question of bonding the village for electric lights and water works was to be voted on January 25.

Sheffield, Tenn.—The Mussel Shoals Power Company, organized here a few days ago, proposes to establish a \$500,000 electrical plant at Mussel Shoals in the Tennessee River and furnish power, light and heat to a number of towns within a radius extending twenty or thirty miles from the station. Ample capital for prosecuting the work is said to be available and there seems to be no doubt here that it will be carried to a successful end. The officers of the concern are: T. L. Carter, president; C. B. Ashe, vice-president; J. R. Coleman, secretary and treasurer.

Shippensburg, Pa.—The Shippensburg Electric Light Company has reorganized and elected the following officers: J. L. Barner, president; W. J. Coffey, treasurer, and James Fleming, secretary.

Sterling, Col.—The town board has appointed a committee consisting of three of its members—C. M. C. Woolman, J. C. Akin and A. G. Sherman—and three citizens to make investigations as to the cost of water-works and an electric light plant.

Stonington, Conn.—A plan is being considered here for furnishing electric lights for the borough and for Noank, Mystic and Old Mystic from one plant. The officers of the board of trade are taking an interest in the question and making investigations as to the feasibility of the project.

Tonawanda, N. Y.—The Tonawanda Street Railway has been sold at sheriff's sale to the Michigan Pipe Company for \$50,000. The new owners will operate the road.

Toledo, O.—A number of East Side business men are seriously considering the question of erecting another electric light plant in this city. The plan proposed is to form a company with \$100,000 stock, one-tenth of the sum to be paid in at once and assessments to follow. The "Blade" says: "The East Side is at present paying exorbitant prices for electric lighting, and the citizens are going to solve the problem by having a plant of their own. The franchise will be asked for as soon as all plans are complete, and the stockholders will petition for the right of way through the alleys of the East Side. Residences and business houses will be lighted from the plant at a much more reasonable rate, it is claimed, than is now charged."

Victor, Col.—Work is to be pushed on the electric railroad between Canon City and Victor with the hope of getting it into operation early in July. The power for the road is to be furnished by an immense water plant at Canon City, from which electric power is to be generated sufficient to operate the line as well as supplying power and electric lighting facilities for the different mines adjacent to the company's right-of-way.

PERSONAL AND MISCELLANEA.

Frank Gilchrist, chief electrician at the Etna Standard Iron & Steel Works at Mingo Junction, O., was instantly killed on the evening of the 16th inst. by the explosion of a separator connected with the electrical department. He was thirty-five years old and leaves a wife and two children.

The only son of King Humbert of Italy is passionately fond of electrical research, and is said to be well acquainted with almost every species of electrical application, whether it relate to light, motive power, sound or photography. He has been one of the most successful experimenters with the X-rays. The prince has great admiration for Edison, and if he carries out his intention of coming to America in the spring, will probably make the acquaintance of the "Wizard," if young Tom's ascendancy does not create a doubt in his mind as to which is best entitled to royal cognition.

W. C. Hubbell, president of the Hubbell Electric Light Company of Scranton, Pa., has gone to Europe to negotiate the sale of the foreign patents for the electric bicycle and miner's lamp of which Mr. Hubbell and his son, H. C. Hubbell, are the inventors. Mr. Hubbell was accompanied by E. P. Mucklow of the firm of Boyle & Mucklow, who is interested in the patents.

"One of the softest snaps in all Michigan," says the Saginaw "Herald," "is possessed by the motorman of street car No. 70, which makes a 300-yard run from Washington avenue to the approach of the Bristol street bridge several times a day. He was never known to have a passenger, his report to the headquarters of the line never shows receipts and he runs his lonely car over the ridiculously short space allotted to him at regular intervals—every time it occurs to him and he feels so inclined. There is no danger of a collision on this line, for no other car ever trespasses on the rails set aside for the use of the dummy car. There is no danger, in fact, from any cause, unless it be, perhaps, from ennuui to the lonely occupant, or running too far onto the bridge and taking a cold bath suddenly. The cause of the running of this burlesque car is that the Consolidated Street Railway Company might not lose their franchise, for by abandoning a single division of the system they forfeit the franchise to the entire city."

The Denver "Republican" states that J. C. Henry, of Denver, formerly employed as an expert by the General Electric Company of New York, has just secured a patent for an electric controlling device for trolley cars. By Mr. Henry's method, which does away with brakes, the motor, when a stop is to be made, is changed into a generator by simply turning a handle in control of the motorman. This forces the current back into the wire and by eliminating the friction of ordinary brakes, makes, according to the estimate of the inventor, a

saving of 40 per cent. of the power needed to operate the line. The power that is generated by the change of the motors into dynamos passes into the wire and is used to operate other cars.

The United States Time & Weather Service Company has applied for a franchise in Philadelphia permitting it to erect "meteorological columns" in the streets and connect them with electrical conductors. The columns as described to the council committee are square pillars about 16 feet high. On the top of the column is a time-ball device which by means of electrical connections with Washington would be dropped at noon exactly. Beneath this time ball the column has clock faces showing the hours of the day, and under the clock are panels of glass on which advertisements are to be painted. It appears to be an advertising scheme requiring considerable capital as a starter.

Miss Mary Bardzick, a young woman in the employ of a lamp manufacturing company at New Brunswick, N. J., recently met with a distressing accident, which may result in the loss of both of her eyes. She is a tester of electric light bulbs, and while engaged in this work a lighted bulb above her head exploded with a sharp report, and pieces of the flying glass lacerated her face and entered her eyes. Her shrieks brought several of the workers to her aid and physicians were at once sent for, who did all they could to relieve her, but after an examination stated that her sight could never be restored. The firm, however, has put the girl under the care of New York specialists, and everything possible is being done for her.

"Telescriptor" is the name given to a new invention of R. S. Sample of Huntington, W. Va. It is an electric writing machine and has all the appearances of an ordinary typewriter. The Huntington "Herald" says of it: "The electric writing machine can be connected without special wires to telephone or telegraph lines, only requiring a like machine at the other end. By using the telephone attachment of the machine you call up central for them to connect you to any desired point where there is a like machine as you wish to communicate with him. No. 1 inserts paper also and begins to write the message. The message is written in a familiar, clear, typewriter hand. No. 2 receives his letter and No. 1 retains the copy. In this way the message can be sent over the wires without being read and should make it very convenient for newspaper correspondents and others who have numbers of messages to communicate."

RECENT COMPANY ELECTIONS.

Anacostia & Potomac River Railroad Company, Washington, D. C.—Directors: Daniel A. Christie, Henry C. McCauley, Henry A. Griswold, George H. Harries, Benjamin S. Minor, Thomas E. Smithson and Joseph Z. Williams.

Beacon Electric Company, Lansingburgh, N. Y.—President, J. George Kaelber; vice-president, Samuel Bolton, Jr.; treasurer, William M. Lea; secretary, Gilbert P. Williams; directors: J. George Kaelber, Samuel Bolton, Jr., William M. Lea, G. P. Williams, George W. Daw and Albert Will.

Brush Electric Light & Power Company, Savannah, Ga.—President, S. P. Hamilton; vice-president, D. R. Thomas; secretary, A. Minis; directors: Jacob Bauers, D. Y. Dancy, L. Kayton, G. W. Allen, J. R. Sheldon and John C. Rowland.

Capital Traction Company, Washington, D. C.—Directors: George T. Dunlop, Charles C. Glover, Henry Hurt, John G. Parke, John R. McLean, Edward J. Stellwagen and Wm. Manice.

Chicago City Railway Company, Chicago.—President, M. K. Bowen; vice-president, Joseph Leiter; directors: George T. Smith, Joseph Leiter, W. B. Walker, G. H. Wheeler, S. W. Allerton, D. G. Hamilton and M. K. Bowen.

Chester Electric Light Company, Chester, Pa.—President, H. B. Black; directors: John McGolrick, Joseph Messick, Joseph Deering, George E. Hetzel, I. Engle Cochran, William Provost, Jr., Robert Rigby, John R. Sweeney, Charles Palmer and Rev. George C. Moore.

Chambersburg & Gettysburg Railroad Company, Chambersburg, Pa.—President, W. S. Pilling; vice-president, W. H. Mole; secretary, H. O. Wood; treasurer, Joseph P. Ranney; general manager, T. I. Crane; directors: C. D. Wood, H. O. Wood, William Barclay Parsons, William H. Mole, New York; W. S. Pilling, T. I. Crane, Philadelphia; J. Burns White, Fayetteville; Joseph P. Ranney, Chambersburg.

Citizens' Electric Light Company, Downingtown, Pa.—Directors: John T. Fox, Joseph R. Downing, Guyon Miller, Dr. Edward Kerr, Joseph H. Johnson, Dr. Thomas A. Parke.

Cleveland City Railway Company, Cleveland, O.—President, M. A. Hanna, vice-president, C. F. Emery; secretary and treasurer, J. B. Hanna; superintendent, George G. Mulhern; directors: M. A. Hanna, C. F. Emery, C. A. Otis, D. P. Eells, J. H. Wade, J. B. Hanna, S. T. Everett, G. G. Mulhern and R. R. Rhodes.

Consolidated Electric Company, Portland, Me.—President, Weston F. Milliken; vice-president, Frederick A. Gilbert; treasurer, William R. Wood; clerk and manager, George E. Raymond; directors: Weston F. Milliken, William R. Wood, Charles R. Milliken, Leander W. Fobes, George P. Wexcott, Clarence Hale, Frederick A. Gilbert, James English, Stephen R. Small.

Columbia Electric Light & Power Company, Columbia, Pa.—President, Dr. Alexander Craig; secretary, Dr. S. A. Bockius; treasurer, E. B. Eckman; superintendent, A. Z. Staman; directors: Dr. A. Craig, E. B. Eckman, J. H. Herr, J. A. Minch, Dr. A. Bockius, A. Z. Staman, Dr. T. M. Livingston, H. H. Cramer, S. W. Guiles, C. R. Stickler, A. J. Kauffman and Dr. A. W. Rogers.

Cumberland Valley Electric Passenger Railway Company, Carlisle, Pa.—President, J. S. Baughman, New Cumberland; secretary, W. K. Myers, Harrisburg; treasurer, J. R. Miller; directors: O. A. Lee, J. D. Landes, J. S. Baughman, W. K. Myers and J. R. Miller.

Columbus Edison Electric Light Company, Columbus, O.—President, Adolf Theobald; vice-president, Joseph F. Martin; treasurer, Emil Klesewetter; secretary and manager, A. W. Field; directors: Adolf Theobald, Charles H. Lindenberger, Joseph F. Martin, Emil Klesewetter, John Siebert, Louis Siebert, F. E. Drake, A. W. Field and J. R. Lovejoy.

Cumberland Valley Traction Company, Carlisle, Pa.—President, G. W. Cumber, Steelton; secretary, F. H. Alleman, Steelton; treasurer, W. L. Gorgas, Harrisburg; directors: J. L. Kaufman, S. F. Dunkle, John B. Skiles, Dr. H. W. Linebaugh, B. F. Myers, J. J. Baughman, G. W. Cumber, F. H. Alleman and W. L. Gorgas.

Elwood Electric Street Railway Company, Elwood, Ind.—President, J. H. DeHority; treasurer, W. A. DeHority; secretary and manager, S. B. Harting; directors: J. H. DeHority, H. G. Harting, C. J. Taylor, H. C. Callaway, C. C. DeHority, E. O. Heck and W. A. DeHority.

Fair Haven & Westville Street Railroad Company, New Haven, Conn.—President, Henry S. Parmelee; vice-president, Samuel Hemingway; secretary and treasurer, Levrett Candee; directors: Henry S. Parmelee, Samuel Hemingway, John B. Carrington, E. Hayes Trowbridge, George D. Watrous, James S. Hemingway, Wilbur F. Day, Samuel E. Merwin.

Georgetown & Tenleytown Electric Railway Company, Washington, D. C.—President, Oscar T. Crosby; vice-president, J. Hite Miller; secretary and treasurer, William S. Terry; directors: Oscar T. Crosby, H. Bradley Davidson, Charles A. Leib, George E. Emmons, D. M. Myrick, Howard Nynian, W. S. Terry, J. W. Lackey and J. Hite Miller.

Greensburg, Jeannette & Pittsburg Electric Railway Company, Pittsburg, Pa.—President, ex-Judge W. F. Sadler, Carlisle; secretary, M. F. Thompson, Carlisle; directors: W. A. Coffee, H. G. Beetem, Edward Bailey, W. J. Snively, P. Russ and J. B. Kauffman.

Hackensack Gas & Electric Light Company, Hackensack, N. J.—Directors: George W. Conklin, Frank B. Poor, E. A. Pearce, William M. Johnson, Lemuel Lozier, David St. John, Jacob Bauer.

Jefferson Avenue Railway Company, St. Louis.—Directors: Edwards Whitaker, Pierre Chouteau Maffitt, Robert McCulloch, John Scullin and Harry Scullin.

Jeffersonville Gas, Heating & Electric Light Company, Jeffersonville, Ky.—President, E. C. Eaken; secretary and treasurer, A. A. Swartz; directors: E. C. Eaken, A. Swartz, N. H. Myers, T. J. Lindley and J. E. Taggart.

Middletown, Highspire & Steelton Street Railway Company, Middletown, Pa.—Directors: Solomon Zimmerman, S. C. Young, Edward Bailey, J. E. Rutherford, E. C. Felton and George W. Cumber.

Milwaukee, Racine & Kenosha Electric Railway Company, Milwaukee, Wis.—President, Mathew Slush; vice-presidents, A. W. Bishop and W. Greif; secretary and treasurer, George J. Hoffman; directors: Mathew Slush, A. W. Bishop, Racine; George J. Hoffman, N. I. Dryfoos, William Greif, Edward Weberson and Russell Brown, Cleveland, O.

Montville Street Railway Company, Norwich, Conn.—President, Solomon Lucas; secretary, Charles W. Comstock; treasurer, Edward P. Shaw, Jr.; directors: Solomon Lucas, John H. Barnes, Norwich; Edwin O. Johnson, Charles W. Comstock, Montville; Edward P. Shaw, Jr., Brookline, Mass.

Myersville & Catoctin Railway Company, Middletown, Md.—President, Cyrus F. Flook; secretary, George D. Toms; treasurer, John T. Hildebrand.

North Hudson County Railway Company, Hoboken, N. J.—Directors: M. Tierney, E. A. Stevens, Nicholas Goetz, F. J. Mallory, J. Herbert Ballantine, Robert F. Ballantine, Robert W. DeForrest, C. Henry Offerman, Allen L. McDermott.

Philadelphia & Gray's Ferry Passenger Railway Company, Philadelphia.—President, Edward Hopkinson; treasurer, Lewis S. Renshaw; directors: Richard Dale, S. W. Woodhouse, B. Frank Hart, Lewis Elkin, Isaac W. Jeanes and William Dulles.

Pottsville & Reading Electric Railway Company, Pottsville, Pa.—President, F. H. Treat; directors: Thomas B. Prosser, C. P. King, E. L. Nichols, H. H. Pearson, Jr., and M. S. Collingswood.

Roxborough, Chestnut Hill & Norristown Railway Company, Conshohocken, Pa.—President, Robert M. Carson; vice-president, C. Martin Brill; secretary and treasurer, W. H. Hantsch; directors: C. Martin Brill, Henry W. Biddle, George A. Fletcher, Robert M. Carson, John A. Brill, William Ring, Samuel F. Houston, R. Nelson Buckley.

Schuylkill Traction Company, Girardville, Pa.—Directors: Dallas Sanders, George H. Earle, Jr., W. B. Gill, Herbert M. Howe, John A. Johann, Joseph P. Richards and Winthrop Smith.

St. Louis & Suburban Railway Company, St. Louis.—President, Charles H. Turner; vice-president, Samuel M. Kennard; secretary and treasurer, Robert Lehman; directors: James Jackson, James Green, Charles C. Maffitt, Ellis Wainwright, Clark H. Sampson, J. B. Case, J. O. Richardson.

St. Louis & Meramec River Railway Company, St. Louis.—President, Charles H. Turner; vice-president, J. B. Case, secretary and treasurer, R. Lehman; directors: Charles H. Turner, S. M. Kennard, H. Nicolaus, J. B. Case, Ellis Wainwright.

Toledo, Bowling Green & Fremont Railway Company, Bowling Green, O.—Directors: W. B. Taylor, F. J. Hoag, George H. Breymann, M. I. Wilcox, B. Jacoby and James A. Houston, of Toledo, and F. T. Mussey, of Elyria. The number of directors was reduced from 15 to 7.

Utica Electrical Manufacturing & Supply Company, Utica, N. Y.—President, William E. Lewis; vice-president, W. H. Clobber, Jr.; secretary and treasurer, M. Jesse Brayton; directors: William E. Lewis, M. Jesse Brayton, William H. Clobber, Jr., Frank S. Ferriss, W. C. Balda.

West Chicago Street Railroad Company, Chicago.—Directors: Charles T. Yerkes, William L. Elkins, P. A. B. Widener, Harvey T. Weeks, S. W. Rawson, F. H. Winston, J. M. Roach.

York Street Railway Company, York City, Pa.—President, W. H. Lanus; directors: D. K. Trimmer, Grier Hersh, George P. Smyser, John Fahs, L. A. Marshall, Charles Kurtz.

COMMERCIAL PARAGRAPHS.

Messrs. Tower, Dawson & Co. of 806-308 Broadway, New York, are the sole agents for the Franklin Typewriting Machine, which is unquestionably one of the best, if not the best, typewriters now on the market. In the Franklin No. 5, their latest production, is found every quality necessary to make up a perfect machine. It is handsomely made, has an attractive appearance, and moreover, can readily be taken apart for cleaning and easily put together. The writing always being in sight effects a great saving of time. We would call attention to their advertisement, which appears on the second advertising page of this issue, and feel justified in asserting that the claims Messrs. Tower, Dawson & Co. make for their machine are in every respect true. The price as stated in the advertisement is but \$75, and any one investing in the Franklin No. 5 will be getting good value for his money. The company will send a descriptive booklet on request.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The Prouty Electro-Gasoline Engines, manufactured by E. Prouty, 79 Dearborn street, Chicago, are compact, handsomely made, and of great practical merit. We would call attention to Mr. Prouty's advertisement, which is to be found in this week's issue, and would state that the manufacturer of this engine would be only too glad to have any prospective purchaser examine carefully into the scientific and practical merits of this machine. Contrary to the policy pursued by many manufacturers of this class of apparatus, Mr. Prouty courts a thorough investigation of the working of his gasoline engines, and will cheerfully furnish any desired information regarding the efficiency and capabilities of his machines. Persons contemplating purchasing engines of this nature would do well to open correspondence with Mr. Prouty with a view to getting information on the subject.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

The Upton Midget Long-Burning Arc Lamp is already a very popular specialty. The small size, light weight and tasty appearance of the lamp make it a very desirable arc lamp for inside work, while its positive and steady action and general reliability make it a popular lamp for all places where a long-burning arc lamp is required. The Electric Appliance Company, Chicago, will be glad to send their latest circular on this specialty on application.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

INCORPORATIONS.

The Aurora Arc Lamp Manufacturing Company, Pittsburg, Pa. Capital stock, \$1,000. Incorporators: Conrad Weber, Frederick Clausman, William Isensee, A. Schonn and George Schlinder.

The Citizens' Electric Light Company, Winchester, Ind. Capital stock, \$20,000.

The Elwood, Anderson & Lapelle Railroad Company, Elwood, Ind.—to run an electric line from Elwood to Anderson and Lapelle, a distance of twenty-five miles. Capital stock, \$50,000. Directors: D. G. Reid, L. H. Landon, J. E. Hagen, W. M. Leeds, W. B. Leeds, H. M. Davis and C. W. Bennett.

The Nashville Light & Power Company, Nashville, Tenn. Capital stock, \$25,000. Incorporators: C. M. McGhee, L. D. Tyson, N. Baxter, Jr., Shelby Williams and E. G. Connette.

The Hightstown Electric Light & Power Company, Hightstown, N. J.—to supply electric light and power to Hightstown, Cranbury and near-by places. Incorporators: Francis C. Thorn, Delanco; Charles P. Fitch, Bermley; Theodore Nostrand, Philadelphia.

The Delaware Valley Railway Company, Delhi, N. Y.—to construct and operate an electric road from Delhi to Andes and Bovina Center, N. Y. Capital stock, \$150,000.

TELEPHONE AND TELEGRAPH.

Incorporators and directors: Henry Davie, J. R. Honeywell, Samuel F. Wilbur, George W. Youmans, of Delhi; James F. Scott, W. C. Oliver, of Andes; T. E. Hastings and Alexander Hilson, of Bovina Center, and H. S. Sewall, of Walton.

The Armour Electric Light, Fuel & Power Company, Chicago, has certified to a change of name to Alaska Company and to an increase of capital stock from \$50,000 to \$500,000.

The Standard Light & Power Company, Dallas, Tex.—to supply light, heat and electric motive power to the public. Capital stock, \$100,000. Incorporators: Emmett A. Ellis, L. Ashton and C. H. Alexander.

The American Dynamo-Engine & Motor Lamp Company, Memphis, Tenn.—to manufacture and sell dynamo-engines, motors, lamps and electrical appliances. Capital stock, \$150,000. Incorporators: C. C. Cowan, Jere Horne, M. L. Whitfield, John E. Bell and J. S. Williams.

The Braid Electric Company, Nashville, Tenn.—to deal in electrical machinery. Incorporators: J. W. Braid, W. W. Gambill, Thomas Jones, E. C. Andrews and M. C. Woolwine.

The Azusa Electric Lighting & Power Company, Azusa, Los Angeles County, Cal. Capital stock, \$5,000. Incorporators: Orlando H. Huber, Vint M. Greever, Charles C. Casey, Stillman F. De Voin, Evan Davis, John W. Calvert, Thomas C. Bouldin.

The Metropolitan Electric Construction Company, New York City—to construct and equip with electrical apparatus for purposes of transportation and other purposes railways and other works of a public and private character. Capital stock, \$50,000. Incorporators: A. B. Chandler and Edward C. Platt, Brooklyn; Edward H. Johnson, of New York City, and William D. MacQueen and Herbert T. Jennings, of Mt. Vernon, N. Y.

The Lawrenceville Light & Water Company, Lawrenceville, Ind. Capital stock, \$25,000. Incorporators: M. L. Liscomb, F. C. Spring and G. E. Engstrom.

The Burnham-Hall-Chase Company has been organized at Portland, Me., for the purpose of the manufacture, purchase and sale of electrical supplies and specialties, with \$2,000 capital stock, of which nothing is paid in. The officers are: President, Frederic A. Hall of Chelsea, Mass.; treasurer, William W. Burnham of Boston, Mass.—The C. W. Trainer Manufacturing Company also has been organized at Portland for the purpose of doing a general asbestos business and to deal in electrical goods, with \$50,000 capital stock, of which \$5,000 is paid in. The officers are: President, Eugene W. Hough of Boston, Mass.; treasurer, Charles W. Trainer of Boston, Mass.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 18, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 597,432. Electric Car-Brake. Constant F. de Redon, New York City. Filed Sept. 22, 1896.
- 597,433. Electromagnetic Railway-Car Brake. Constant F. de Redon, New York City. Filed April 22, 1897.
- 597,467. Trolley Car. Jeremiah D. Hull, New York City. Filed Feb. 1, 1897.
- 597,508. Conduit for Electric Railways. Cyrus V. Osborn, Dayton, O. Filed July 18, 1896.
- 597,516. Electric Trolley Device. Gustaf Valley, Johnstown, Pa., assignor to the Steel Motor Company, same place. Filed March 8, 1897.
- 597,650. Electric Lock and System of Electric Locking for Securing Additional Safety in Railroad Signaling. James F. W. Morris and George Mumford, London, England; said Morris assignor to William Samuel Totill Martin, same place. Filed Oct. 16, 1896.
- 597,693. Trolley-Wheel. Harry B. Sawyer, Chicago, Ill., assignor of one-half to Meyer Wheeler, same place. Filed June 19, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 597,424. Electric-Arc Lamp. Adolphe Mougin, Paris, France, assignor to La Societe les Fils d'Adolphe Mougin Hericourt, France. Filed Feb. 13, 1897.
- 597,492. Filament for Incandescent Lamps. Frank E. W. Bowen, London, England. Filed Aug. 17, 1897.
- 597,586. Signal-Telegraph. Claudius V. Boughton, Buffalo, N. Y. Filed Dec. 19, 1895.
- 597,601. Electric-Arc Lamp. Emanuel Blaser, California, Mo., assignor to Charles G. Corrao, Mattapan, Mass. Filed July 15, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 597,418. Regulation of Dynamo Electric Machinery. Frederic A. Johnson, Binghamton, N. Y. Filed April 14, 1897.
- 597,419. Regulation of Dynamo-Electric Machinery. Frederic A. Johnson, Binghamton, N. Y. Filed April 24, 1897.
- 597,470. Rheostat. Mortimer Norden, New York City, assignor to Joseph Norden, same place. Filed April 12, 1897.
- 597,472. Electromechanical Switch-Operating Mechanism. Charles W. Squires, Springfield, Mass. Filed April 9, 1897.
- 597,567. Transmission-Dynamometer. Stillman W. Robinson, Columbus, O., assignor to Frederick A. Riehle, Philadelphia, Pa. Filed Feb. 27, 1896.
- 597,642. Electric Switch. Everett M. French, Stoughton, Mass. Filed Sept. 16, 1897.
- 597,616. Machine for Assorting Carbons. Harry S. Hart, Chicago, Ill. Filed Aug. 2, 1897.
- 597,700. Circuit-Breaker. Frederick C. Robertson, Toronto, Canada. Filed July 22, 1895.

TELEPHONE AND TELEGRAPH APPARATUS.

- 597,556. Coin-Controlled Apparatus for Telephones. William Gray, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, same place. Filed Dec. 20, 1899.
- 597,587. Telegraphic Signal. James Nicolson, Buenos Ayres, Argentina. Filed Feb. 26, 1897.
- 597,689. Keyboard Telegraphic Transmitter. Samuel Price, Paterson, N. J. Filed June 17, 1897.

MISCELLANEOUS.

- 597,476. Electric Furnace. Thomas L. Wilson, New York City, assignor to the Electro Gas Company, same place. Filed Nov. 15, 1895.
- 597,517. Apparatus for Producing Ozone or Ozonized Air. Albert Verley, Paris, France. Filed Feb. 17, 1897.

Annual Meeting of the Indiana Mutual Association.

The Indiana Mutual Telephone Association held its annual meeting at the Bates House, Indianapolis, on the 19th inst. E. H. Andrews of Lafayette, president of the association, said in his address that the independent telephone business throughout the State is on the increase, both in the number of subscribers to older exchanges and in the number of new exchanges which are being put in.

George W. Beers, of the Home Telephone Company of Ft. Wayne, stated that his company has 1,400 subscribers and 700 miles of wire reaching other towns in Indiana and Ohio. He said that each of the home companies has its local exchange connected with smaller towns near by, and this kind of service is on the increase.

A committee was appointed at the last annual meeting to confer with similar committees of independent associations in Pennsylvania and Ohio. Their report showed that the independent enterprises were carried on in the two States named and in Indiana to a greater extent than in others. In the three States there are 250 independent exchanges, with more than 100,000 subscribers, and the capital invested is more than \$5,000,000. The report said that the demand upon home companies for long-distance service was extending. That this might be met, it was stated that in the three States organizations are forming to further this work; committees from the three States had been appointed. That from Indiana consists of E. H. Andrews, George W. Beers and Hugh Daugherty. The committees had conferred with the Western Union and Postal Telegraph Companies, with the object of forming an alliance of some kind whereby the long-distance lines might be established. But the possibilities are so remote, the committee said, that about the only way to obtain the desired result is to incorporate the independent exchanges of the State into one company, with sufficient capital to build the connecting lines. It was recommended in the committee's report that this movement be taken up at once and developed as rapidly as possible.

The following officers were elected for the ensuing year:

President—E. H. Andrews, of Lafayette.
Vice-President—J. S. Stone, of Rushville.
Secretary and Treasurer—A. E. Reynolds, of Crawfordsville.

Assistant Secretary—W. H. Ernst, of Bluffton.

Executive Committee—E. H. Andrews, J. S. Stone, A. E. Reynolds, George W. Beers, of Ft. Wayne; C. M. Zion, of Lebanon; Elbert Shirts, of Noblesville; A. E. Ramsey, of Crawfordsville.

The stockholders of the Citizens' Telephone Company met lately in Columbia, Tenn., to hear read a financial report from the secretary and treasurer and to consider a proposition made by the Cumberland Telegraph & Telephone Company (Bell) to buy out the Citizens' plant. Dr. Pillow, the president of the Citizens' Company, stated that the company was in debt \$4,410, and that it would require another \$1,000 to place the exchange in first class condition, yet none of those present favored a sale to the Cumberland Company, and the proposition of that company was thrown aside unheard. Roland Gooch said he considered the proposition of the Bell people to purchase a \$13,000 plant for \$4,400, which he understood was the sum offered, as an insult. It was moved that subscriptions be called for and the amount of \$5,500 raised. Prominent men all over the house jumped to their feet and in a little while nearly \$3,300 was volunteered. A committee of fifteen was appointed to canvass the subscribers not present and report at the next meeting. Every means has been used by the Cumberland Company to down the Citizens' Company, but without success. Rates have been reduced to 50 cents per month, but the citizens banded together and nearly all the business houses in Columbia signed an agreement not to allow the Bell 'phone in their houses.

The Athens (N. Y.) News says: "The telephone company here has signed contracts with twenty railroad men, mostly living in Waverly, to place telephones in their residences for the purpose of giving them notice when wanted to go out on their runs. The 'phone connections with the round house at Sayre are being made and the connections with the residences will be made as soon as the work can be done. To start with, the engineers and firemen are putting in 'phones, but the conductors and brakemen will no doubt follow suit very quickly. It looks very much as if the call boy would lose his vocation. It is said that the telephone service will give the men considerable more time to get ready for their runs, as the call boys have a number of men to call most of the time and the last man that he reaches has to hustle to make connection with his train."

In the lower House of the Legislature at Albany on the 20th inst., Assemblyman Cain introduced a bill for the reduction of telephone rates. It provides that six months after the passage of the act the charge for the annual or monthly use of a telephonic communication both by day and night, together with such instruments and electrical apparatus as shall be necessary to transmit vocal messages

between the patrons or subscribers of any telephone company within the limits of this State (which charge and price shall be pro rata for shorter periods) shall be, in cities of one million inhabitants and over not to exceed a rate of \$85 per annum; cities of 500,000 and less than a million, not to exceed \$75; in cities of 100,000 and less than 500,000 inhabitants, not to exceed \$48; in cities of 20,000 and less than 100,000, not to exceed \$36; in places of 8,000 and less than 20,000 inhabitants, not to exceed \$30, and in all cities and places of less than 8,000, not to exceed \$27.

The exchange of the Delmarvia Telephone Company at Wilmington, Del., was recently inspected by a number of representatives of various telephone companies who pronounced it one of the handsomest and most complete in the United States. The exchange is built to accommodate one thousand subscribers, and every device in modern telephony has been adopted. The Delmarvia Company has now about 350 'phones in operation and are putting in new ones at the rate of fifty per week. The rates are \$36 for business houses and \$24 for residences per year. The Bell Company has reduced its rates to meet those of the new company. This has had no effect other than to attach the public to the Delmarvia.

The Pennsylvania Telephone Company at its annual meeting at Harrisburg, held last week, voted to increase its indebtedness for the purpose of making improvements. The following officers were elected: President, Francis Jordan; vice-president, A. R. Shallenberger; secretary and treasurer, J. Heron Crossman, Jr.; general manager, M. H. Buehler, all of Harrisburg, with T. J. Lerch, Reading, general superintendent.

At the annual meeting of the Saugatuck & Ganges Telephone Company, Saugatuck, Mich., it was shown by the secretary's report that the annual cost of maintaining and operating the plant has been \$10.25 per 'phone. It was decided not to sell out to the Ottawa Telephone Company with their promise of a rental of \$12 per year. The service will be extended and the business managed with a view to better economy.

Judge Coolidge recently refused the Bell Telephone Company an injunction restraining the city of Benton Harbor, Mich., from removing its poles and interfering with the construction of more lines. The city some months ago removed the Bell poles, and since that time it has been in the courts. Holland and other Michigan cities have followed Benton Harbor's action.

A six-mile submarine cable has just been completed at Passaic, N. J., for the Postal Telegraph Company. It is the longest of its size ever made in this country and weighs 125,000 pounds. Its diameter is one and three-quarter inches. It will be stretched across Great South Bay between Fire Island and Babylon, giving the Postal a marine service of its own.

The Swedish telephone industry is a Government monopoly. The network includes at present 27,000 instruments, distributed over about 600 stations. The population amounts to about five millions, and as nearly every town is connected, the system is extremely complete.

A company has been organized at Romney, W. Va., to build a telephone line to Cumberland. The officers are: President and general manager, A. B. C. Whitacre; secretary and treasurer, E. V. Parker; attorney, John J. Cornell.

The Chicago Telephone Company's annual statement shows the gross earnings to have been in 1897 \$2,072,000, an increase over the previous year of \$116,250; net earnings, \$624,694, increase \$24,400; surplus, \$104,000, increase \$4,000.

The Mercer County Telephone & Telegraph Company, Mercer, Pa., has elected Dr. L. R. Heath president, G. K. Smith vice-president, J. Alexander secretary, and John Gordon treasurer.

A private telephone line between Dickson and Charlotte, Tenn., will be built by citizens of the two towns as soon as the county court grants them right of way.

A report is current that a Belgian syndicate is about to be organized for the purchase of a Brazilian telephone concession.

The Bell Company in St. Louis began sending messages through the new conduits on the 16th inst.

New Companies Incorporated.

The Washington County Telephone Company, Plymouth, N. C.—to build and operate a telephone line from Plymouth to Criswell and intermediate points. Incorporators: W. H. Ward, B. O. Crinkley, G. W. Roper, E. S. Chesson, T. J. Basnight and J. F. Belarge.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

Capital Stock.							Rate and Date of Last Div.		Bld. Asked.		Capital Stock.							Rate and Date of Last Div.		Bld. Asked.	
NAME.	Par	Authoriz'd	Issued.								NAME.	Par	Authoriz'd	Issued.							
Albany, N. Y.—Jan. 24:																					
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1 1/4 % Q., Aug. '97.	132 1/2	133 1/4					Hartford Conn.—Jan. 24:	100	\$2,000,000	\$200,000	3 % S., July, '97.	189	..				
Troy City Railway Co.....	100	2,000,000	2,000,000	1 % Q., Sept. 10, '97.	69 1/2	71					Hartford & West Hartford RR.....	100	1,000,000	247,000				
Traction Co. (Saratoga).....	100	50,000	50,000	.....	..	..					Holyoke Mass.—Jan. 21:									
Allentown, Pa.—Jan. 24:											Holyoke Street Ry. Co.....	100	400,000	400,000	4 1/4 % A., July, '97.	203	203				
Allentown & Lehigh Val. Trac. Co.....	....	4,000,000	1,500,000	.....	..	80					Hoboken, N. J.—Jan. 24:									
Bridgeport, Conn.—Jan. 21:											North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000	8 %, 1892.	70	..				
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1 % Aug., '97.	45	60					Indianapolis, Ind.—Jan. 24:										
Baltimore, Md.—Jan. 24:											**Citizens' Passenger Ry.....	....	5,000,000	5,000,000	.....	20 1/2	21			
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000	5 % S., July 2, '97.	56 1/2	66 1/2					Lancaster, Pa.—Jan. 24:										
Baltimore Traction Co.....	25	10,000,000	5,750,000	1 1/2 % Q., Jan., '97.	23 1/2	23 1/2					Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	..	..	
Central Ry. Co. of Baltimore City..	50	800,000	800,000	6 % A., 1897.	80	..					Lancaster & Col. Electric Ry.....	....	..	87,500	.....	..	..	
Civ. & Suburban Ry. Co.....	50	4,000,000	4,000,000	2 % A., Jan., '97.	48	..					West End Street Railway.....	....	..	..	.....	..	..
Boston, Mass.—Jan. 24:											Louisville, Ky.—Jan. 24:										
New England Street Ry.....	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..					Louisville Ry.....	100	4,000,000	4,000,000	1 1/4 % A., Apr., '97.	10	41			
North Shore Traction Co.....	100	4,000,000	4,000,000	3 % S., Oct., '96.	10	15					Louisville Ry.....	100	2,000,000	2,000,000	2 1/2 % S., Apr. 1, '97.	94	96				
North Shore Traction Co.....	100	2,000,000	2,000,000	6 % S., A. & O.	73	75					Minneapolis, Minn.—Jan. 21:										
West End Street Ry. Co.....	50	10,000,000	9,085,000	4 % S., Oct., '97.	82 1/2	83					Twin City Rapid Transit.....	100	17,000,000	15,010,000	.....	15	20			
West End Street Ry. Co.....	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	103	104					Twin City Rapid Transit.....	....	8,000,000	1,187,200	1 1/4 % A., Apr., '97.	..	10			
Brooklyn, N. Y.—Jan. 24:											Montreal, Canada.—Jan. 24:										
Brooklyn City & Newtown Ry.....	100	2,000,000	1,000,000	2 1/4 % Aug. 1, 1897.	178	180					Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8 % S., M. & N.	241	243				
Brooklyn Rap. Transit Co., Inc. certifi.	100	20,000,000	20,000,000	.....	38 1/2	39 1/2					Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1 1/4 % S., J. & J.	94	91 1/2			
*Brooklyn Heights Railroad.....	100	200,000	200,000	.....	..	..					Memphis, Tenn.—Jan. 24:									
*Brooklyn City RR.....	100	12,000,000	12,000,000	2 1/2 % Q., July, '97.	202 1/2	204					Citizens' Street Railway Co.....	100	1,500,000	1,500,000	.....	15	..			
*Brooklyn, Queens Co. & Sub. RR.....	100	2,000,000	2,000,000	.....	..	..					New Haven, Conn.—Jan. 24:									
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1 1/4 % July 1, '97.	150	180					Fair Haven & Westville RR.....	25	1,500,000	900,000	4 % S., Sept. '96.	57	60				
Kings County Elevated.....	100	4,750,000	4,750,000	.....	47 1/2	50					New Haven Street Railway Co.....	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60	80			
Kings County Traction Co.....	100	4,500,000	4,500,000	1 % July 26, '97	35	..					New Haven & Centerville.....	100	700,000	800,000	.....	..	..	
Nassau Electric Railroad.....	50	6,000,000	6,000,000	.....	..	..					Winchester Avenue RR.....	25	1,000,000	600,000	.....	40	42			
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	..	..					New Orleans, La.—Jan. 17:									
*Brooklyn, B. & W. E. Railroad.....	100	1,000,000	1,000,000	.....	74	80					Canal & Claiborne RR. Co.....	40	240,000	240,000	2 1/2 % S., July, '95.	140	160			
Buffalo, N. Y.—Jan. 24:											New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	1 1/2 % Q., Apr., '97.	123	12 1/2				
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	1 % Q., Sept., '97.	56	58					New Orleans Traction Co.....	100	5,000,000	5,000,000	.....	3	6			
*Buffalo Railway Co.....	100	6,000,000	5,370,500	1 % Q., Sept., '97.	78	80					New Orleans Traction Co.....	100	2,500,000	2,500,000	6 % S., J. & J.	..	30				
Columbus, O.—Jan. 24:											*Crescent City RR.....	100	2,000,000	2,000,000	3 % S., July, '97.	..	62				
Columbus Street Railroad.....	100	8,000,000	8,000,000	1 % Q., Feb., '97.	48	46					*New Or. City & Lake RR.....	100	2,000,000	2,000,000	4 % S., July, '97.	105	110				
Columbus Central Street Railroad.....	100	1,500,000	1,500,000	.....	..	..					Orleans Railroad.....	50	500,000	185,000	1 1/2 % S., June, '94.	10 1/2	14			
Charleston, S. C.—Jan. 24:											St. Charles Street Railway.....	50	1,000,000	1,000,000	1 1/2 % A., Apr., '97.	55	56				
Charleston City Ry. Co.....	50	100,000	100,000	3 % S., Jan., '97.	..	..					New York—Jan. 24:									
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	..	..					Central Cross-town RR.....	100	600,000	600,000	2 1/2 % Q., July, '97.	230	..			
Chicago, Ill.—Jan. 24:											*Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Apr., '97.	155	165				
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3 % Q., Sept. 15, '97.	237 1/2	238					Dry Dock, E. Bldg. & Battery RR.....	100	1,200,000	1,200,000	1 % Q., Feb., '97.	..	190				
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800	.....	13 1/2	14					*Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1 1/2 % Q., July, '97.	114 1/2	115			
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	3 1/2	4					*Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	4 % A., July, '97.	83	85			
Metropolitan West Side Elev. Ry.....	100	15,000,000	15,000,000	.....	..	..					*Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., July, '97.	205	206			
Met. West Side El. const. stk.....	100	15,000,000	2,500,000	.....	..	..					*Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 % Q., July, '97.	170	..			
North Chicago Street RR.....	100	10,000,000	6,600,000	8 % Q., Oct., '97.	220	224					*Eight Avenue RR.....	100	1,000,000	1,000,000	.....	320	..			
North Chicago City RR.....	100	500,000	249,900	.....	..	..					*42d St. & Grand St. Ferry RR. guar.	100	750,000	718,000	4 1/2 % Q., Aug., '97.	325	840			
South Chicago City Railway.....	100	2,000,000	1,603,200	.....	..	..					*Ninth Avenue RR.....	100	800,000	800,000	.....	180	190			
West Chicago St. RR. Co.....	100	20,000,000	18,189,000	1 1/2 % Q., May, '97.	100	100 1/2					*Sixth Avenue RR.....	100	2,000,000	2,000,000	.....	195	..			
*Chicago West Div. Ry.....	100	1,250,000	624,900	35 % S.	..	..					*Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 1/2 % Q., Aug., '97.	300	325			
*Chicago Passenger Ry.....	100	2,000,000	2,000,000	5 % S.	..	..					Second Avenue RR.....	100	2,500,000	1,862,000	1 1/2 % Q., Jan., '97.	150	..			
Cincinnati, Ohio.—Jan. 24:											Third Avenue RR.....	100	12,000,000	10,000,000	2 % Q., Aug., '97.	180	185				
Cincinnati Inc. Plane Ry.....	50	1,000,000	575,000	.....	..	20					*42d St. Manhaty'le & St. Nich. Av	100	2,500,000	2,500,000	.....	60	65			
Cincinnati Inc. Plane Ry.....	50	150,000	150,000	2 1/2 % S., Feb., '98.	23	25					*Union (Huck)berry Ry.....	100	2,000,000	2,000,000	.....	100	108			
Cincinnati, Newport & Cov. St. Ry.....	100	4,000,000	3,500,000	.....	..	..					Newark, N. J.—Jan. 24:									
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1 1/2 % Q., July, '97.	115	115 1/2					Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000	.....	48 1/2	44			
*Mt. Adams & Eden Park Inc. Ry.....	50	2,500,000	2,200,000	1 1/4 % Q., Oct., '96.	..	..					Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	..	..	
Cleveland, Ohio.—Jan. 24:											*Rapid Transit Street Ry.....	100	501,000	501,000	1 1/4 % A.	180	185				
Akron, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000	.....	40	42					Pittsburg, Pa.—Jan. 24:									
Cleveland City Ry.....	100	8,000,000	7,600,000	3 % Q., Oct., '97.	60	61					Allegheny Traction Co.....	50	500,000	500,000	.....	..	48 1/2			
Cleveland Electric Ry.....	100	12,000,000	12,000,000	1 1/4 % Q., Oct., '97.	52 1/2	53 1/2					*Consolidated Traction Co.....	50	15,000,000	15,000,000	2 % Jan., '98.	12 1/2	12 1/2				
Detroit, Mich.—Jan. 24:											Consolidated Traction Co.....	50	15,000,000	15,000,000	3 % May, '97.	44 1/2	44 1/2				
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	.....	..	..					*Central Traction Co.....	50	1,500,000	1,500,000	.....	..	..	
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000	5 % July, '96.	175	..					*Citizens' Traction Co.....	50	8,000,000	3,000,000	6 % A.	60 1/2	..				
Rapid Railway Co.....	100	250,000	250,000	.....	..	100					*Duquesne Traction Co.....	50	8,000,000	3,000,000	.....	..	..	
Detroit Electric Railway.....	100	1,000,000	1,000,000	.....	..	110					*Pittsburg Traction Co.....	50	2,500,000	1,900,000	8 % Aug., '96.	..	..		
Wyandotte & Detroit River Ry.....	100	250,000	200,000	.....	..	..					Federal St. & Pleasant Valley Ry.....	25	1,400,000	1,400,000	2 1/2 % July, '97.	28 1/2	..			
Dayton, O.—Jan. 24:											*Pgh., Allegheny & Man. Trac. Co.....	50	8,000,000	12,904,839	2 % Aug., '95.	..	..		
City Railway Co.....	100	1,500,000	1,470,600	1 1/4 % Q., Oct. 1, '96.	88	100					*Pittsburg & Birmingham Trac. Ry.....	25	8,000,000	3,000,000	3 % Jan., '96.	187 1/2	19 1/2				
City Railway Co.....	100	600,000	600,000	1 1/2 % Q																	

*Unlisted. †Ex div.

b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$20 per share on outstanding capital paid as rental by lease—West Chicago St. RR. Co.; \$20,000 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j \$5 per annum paid on outstanding capital as rental by lease—North Chicago Street Railroad Company; \$25,000 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lease.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

*Unlisted. † Full paid. ‡ Outstanding.

a Leased to New Orleans Traction Company at 6% on stock.

b Leased to New Orleans Traction Company at 8% on stock.

c Leased to Central Cross-town Railroad at 8% on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavyonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.

i Leased to Metropolitan Street Railway for 18% on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter.

k Leased to Metropolitan Street Railway for \$145,000 per annum.

l Leased to Metropolitan Street Railway

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock. Authorz'd Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Jan. 24:						Boston, Mass.—Jan. 24:					
Union Street Railway Co.....	100	\$850,000 \$850,000	2%, Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000 28,650,000	4% Q., Oct., '97	287½	288½
Northampton, Mass.—Jan. 24:						Erle Telegraph & Telephone Co.....	100	.....	1% Q., Aug., '97.	71	71½
Northampton Street Ry.....	100	800,000 225,000	5% A., July, '97.	165	170	New England Telephone Co.....	..	10,894,600 10,804,600	\$1.25 sh., Q.	130	..
Omaha, Neb.—Jan. 17:						New York.—Jan. 24:					
Omaha Street Ry.....	100	5,000,000 5,000,000	.....	25	..	American Telegraph & Cable Co.....	100	14,000,000 14,000,000	1% Q.	90	92
Paterson, N. J.—Jan. 24:						*Central & South Am. Teleg. Co.....	100	6,500,000 6,500,000	1% Q.	104	106
Paterson Ry. Co.....	100	1,250,000 1,250,000	.....	33	35	*Commercial Cable Co.....	100	10,000,000 10,000,000	1% Q.	180	180½
Providence, R. I.—Jan. 24:						Franklin Teleg. Co.....	100	1,000,000 1,000,000	2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000 8,000,000	.....	58	61	Erle Telegraph & Telephone Co.....	100	5,000,000 4,800,000	1% Q., Aug., '97.	71	71½
Philadelphia.—Jan. 24:						*Gold & Stock Telg. Co. guar. 6%	100	5,000,000 5,000,000	1% Q.	107½	110
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000 2,000,000	.....	14½	..	*International Ocean Tel Co. guar. 6%	100	8,000,000 8,000,000	1% Q.	107½	110
Hestonville, Man. & Fairmount.....	50	1,966,100 1,966,100	2% Q., July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000 2,000,000	.....	50	60
Hest'ville, Man. & Fairm't. 6% pfd.	50	533,900 533,900	3% S.—July 15, '97.	62	65	*New York & New Jersey Tel. Co.	100	5,000,000 3,723,000	1% Q., July, '97.	150	152
aFairmount Pk. & Had. Pass. Ry.	50	800,000 800,000	3% Feb. 1, '97.	60	..	*Pacific & Atlantic Teleg. guar. 4%	25	2,000,000 2,000,000	2% S.	70	76
Union Traction Co.....	30	30,000,000 5,986,095	.....	14½	14½	*Postal Telegraph Cable Co.....	100	15,000,000 15,000,000	1% Q.	99	101
eElectric Traction Co.....	50	8,297,920 8,297,920	.....	71½	71½	*Sout'n & Atlantic Telg. Co. guar. 5%	25	950,000 559,525	2% S.	89	95
eCitizens' Passenger Ry.....	50	500,000 500,000	\$3 share Q.	289	290	*Commercial Union Telegraph Co.	25	500,000 500,000	3% S., July 1, '97.	117	119
eFrankford & Southwark Pas. R.	50	1,000,000 1,000,000	\$14 share A.—Apr. '97	375	..	Western Union Telegraph Co.....	..	97,870,000 97,870,000	1% Q., Oct., '97.	89½	89½
eLehigh Avenue Ry. Co.....	50	1,000,000 1,000,000	A. & O.	40	..	Miscellaneous.—Jan. 24:					
eLombard & South Streets Ry.....	25	1,000,000 1,000,000	A. & O.	89	90½	American Dist. Teleg. (Phila.).....	25	400,000 400,000	.....	14	..
eSecond & Third Streets Ry.....	50	1,060,000 1,060,000	\$9 share A., Mar. '97.	260	..	Bell Teleph. Co. (of Canada).....	100	8,168,000 8,168,000	2% S.	174	175
ePeople's Traction Co.....	50	10,000,000 600,000	3% A., April, '97.	..	..	Chesapeake & Potomac Teleg. Co.	100	.....	.....	64	65
eGermantown Passenger Ry.....	50	1,500,000 572,800	\$5.25 share—1897.	182	..	Chicago Telephone Co.....	100	.....	.....	200	202
eGreen & Coates Passenger Ry.....	50	500,000 150,000	3% July, 1897.	130	..	Central Dist. Prtg. & Telg. Co. (Pgh.)	100	750,000 750,000	.....	..	..
ePeople's Passenger Ry.....	25	1,500,000 740,000	.....	57½	..	Empire & Bay States Telegraph Co.	100	.....	.....	72	78
ePeople's Passenger Ry..... pfd.	50	750,000 277,402	.....	65	..	Hudson River Telephone Co.....	100	2,000,000 2,000,000	1% Q.	65	66
ePhiladelphia Traction Co.....	50	30,000,000 120,000,000	4% S.—Apr. 1, '97.	79½	80½	*Northwestern Telegraph Co. guar.	50	2,500,000 2,500,000	2% Q.	110	115
eCatherine & Bainbridge St.....	50	1,000,000 400,000	6% A.—Mar., '97.	..	..	Providence (R. I.) Teleph. Co.....	50	.....	.....	85	..
eContinental Pass. Ry. Co. guar.	50	1,000,000 580,000	\$6 share—July, '97.	140	..	Southern New Eng. Teleph. Co.....	100	8,000,000 8,000,000	.....	120	122
eEmpire Passenger Ry. Co.....	50	600,000 600,000	.....	..	..			
ePhiladelphia City Pass. Ry.....	50	1,000,000 475,000	\$7.50 share July '97	176½	180						
ePhiladelphia & Gray's Ry. RR.....	50	1,000,000 298,650	\$3.50 share July '97	87	..						
eRidge Avenue Passenger Ry.....	50	750,000 420,000	\$12 share, July '97.	2.2	..						
ePhiladelphia & Darby Ry. guar.	50	.....	\$2 share July, '97.	..	..				
e17th & 19th Sts. Pass. Ry. guar.	50	.....	250,000 1% S., July, '97.	157½	..						
eThirteenth & 15th Sts. Pass. Ry.	50	1,000,000 335,000	\$11 sh. A., July, '97	263	..						
eUnion Passenger Ry. Co.....	50	1,500,000 900,000	\$9.50 sh., July '97	225	226						
eWest Philadelphia Pass. Ry.....	50	750,000 750,000	\$10 share, July '97	225	235						
Rochester, N. Y.—Jan. 24:											
Rochester Railway Co.....	100	5,000,000 5,000,000	.....	17	20						
Reading, Pa.—Jan. 24:											
iReading Traction Co.....	..	1,000,000 1,000,000	Semi-an., Jan. & Jy	10	15						
kCity Passenger Ry.....	50	350,000 350,000	July, '97.	111	..						
lEast Reading Electric Ry.....	50	1,000,000 1,000,000	July, '97.	60	..						
St. Louis Mo.—Jan. 24:											
Fourth Street & Arsenal Ry.....	50	300,000 150,000	.....	..	..			
Jefferson Avenue Ry. Co.....	50	400,000 400,000	2% Dec., 1888.	..	..				
Lindell Ry.....	100	2,500,000 2,400,000	1% Q., July, '97.	124	126						
National Railway Co.....	..	2,500,000 2,479,000	1% Q., July, '97.	..	..				
Cass Avenue & Fair Grounds.....	100	2,500,000 2,500,000	.....	..	..			
Citizens' RR.....	100	2,000,000 1,500,000	4% Oct., '98.	90	110						
St. Louis RR.....	100	2,000,000 2,000,000	2% Q., July, '97.	95	105						
Missouri RR.....	50	2,400,000 2,300,000	1% Q., July, '97.	170	172½						
People's RR Co.....	50	1,000,000 300,000	50c., Dec., '89.	..	..				
Southern Electric Ry.....	50	500,000 500,000	.....	50	52½						
Southern Electric Ry..... 6% pref.	100	1,000,000 1,000,000	3% S., Jan., '96.	100	102½						
St. Louis & Suburban Ry.....	100	2,500,000 2,500,000	.....	53½	55½						
Union Depot RR.....	100	4,000,000 4,000,000	3% A., July, '95.	..	175						
San Francisco, Cal.—Jan. 24:											
California St. Cable RR.....	100	1,000,000 600,000	50c. monthly.	108¾	109½						
Geary Street Park & Ocean RR.....	100	1,000,000 375,000	\$2.50 share, '96.	40	50						
Market Street Ry.....	100	18,750,000 18,750,000	Q., 60c. per share.	52½	52¾						
Presidio & Ferries RR.....	100	1,000,000 550,000	.....	6	8						
Scranton, Pa.—Jan. 24:											
Scranton Railway Co.....	50	6,000,000 2,500,000	.....	7½	10						
mScranton & Carbondale Trac. Co.	100	500,000 500,000	.....	15	..						
nScranton & Pittston Traction Co.	100	1,050,000 1,050,000	.....	9	11						
Springfield Ill.—Jan. 24:											
Springfield Consolidated Ry.....	100	750,000 750,000	.....	..	11						
Springfield O.—Jan. 24:											
Springfield Street Ry.....	100	1,000,000 1,000,000	.....	..	2						
Springfield, Mass.—Jan. 21:											
Springfield Street Ry.....	100	1,200,000 1,000,000	8% A.	205	210						
Toronto Canada.—Jan. 24:											
Toronto Ry. Co.....	100	6,000,000 6,000,000	1% Q. S.	94	94½						
Montreal Street Railway Co.....	100	4,000,000 4,000,000	4% S.	241	243½						
Washington, D. C.—Jan. 24:											
Belt Ry. Co.....	50	500,000 500,000	.....	..	..			
Capital Traction Co.....	100	12,000,000 12,000,000	65c. per sh. Oct. '97.	61	62						
Columbia Ry. Co.....	50	400,000 400,000	5% A.	63	68						
Eckington & Soldiers' Home Ry.....	50	707,000 652,000	.....	..	..			
Georgetown & Tenallytown Ry.....	50	200,000 200,000	.....	..	..			
Metropolitan RR. Co.....	50	1,000,000 437,180	2% Q.	120	..						
Worcester, Mass.—Jan. 24:											
*Worcester Traction Co.....	100	3,000,000 3,000,000	.....	16	18						
*Worcester Traction Co..... 6% pfd.	100	2,000,000 2,000,000	3% S., Sept., '97.	95	97						
Worcester & Suburban Street Ry.....	100	550,000 542,500	4%, 1896.	85	..						
Wilkesbarre, Pa.—Jan. 24:											
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000 5,000,000	1%, Jan., '97.	24	29						

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

d Practically all shares owned by Union Traction Company.

e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

f Lease to Electric Traction Company.

g Controlled by Frankford & Southwark Passenger Railway.

h Leased to People's Passenger Railway at \$5 per share.

i Majority of stock owned by People's Traction Company.

j Leased to Union Traction Company.

k Lease transferred to Union Traction Company.

l Leased to Union Traction Co. at a rental of \$10,000 per an. in 1886-7-8, \$20,000 p. a. in 1889-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.

m Dividend of 10% guaranteed by Reading Traction Company.

n Dividend of 6% guaranteed by Reading Traction Company.

o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ALLIED INDUSTRIES.

Boston Mass.—Jan. 24:											
American Electric Heating Co.....	50	10,000,000	.....	.....	.....	..	..	..	..	..	..
Street Ry. & Illu'g Properties..... pfd.	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	..	..	..	..	..	..	..
United Electric Securities Co..... pfd.	100	.....	.....	3½ % , Feb., '96.	80	85	80	85	80	85	85
New York.—Jan. 24:											
Consolidated Electric Storage Co...	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Edison European.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Safety Car Heating & Lighting Co.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Worthington Pump Co.....com.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Worthington Pump Co..... pfd.	100	5,500,000	5,500,000	.....	.....	.....	.....	.....	.....	.....	.....
Worthington Pump Co..... pfd.	100	2,000,000	2,000,000	7 %	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa.—Jan. 24 :											
Acetylene L. H. & P. Co.....\$35 pd.	50	1,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
United Gas Improvement Co.....scrip.	50	10,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Welsbach Commercial Co.....com.	100	8,500,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Welsbach Commercial Co..... pfd.	100	500,000	.....	2 % Q	.....	.....	.....	.....	.....	.....	.....
Welsbach Light Co.....	5	525,100	.....	.....	.....	.....	.....	.....	.....	.....	.....
Welsbach Light Co., Canada.....	5	500,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg, Pa.—Jan. 24:											
Carborundum Mfg. Co.....	100	200,000	200,000	.....	.....	.....	.....	.....	.....	.....	.....
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	.....	.....	.....	.....	.....	.....	.....
Miscellaneous.—Jan. 24 :											
*Barney & Smith Car Co.....com.	100	.....	1,000,000	.....	.....	.....	.....	.....	.....	.....	.....
*Barney & Smith Car Co..... pfd.	100	.....	2,500,000	2 %	.....	.....	.....	.....	.....	.....	.....
Billings & Spencer Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Consol. Car Heating Co.....	100	1,250,000	1,250,000	3% S, pas. Feb div.	.....	.....	.....	.....	.....	.....	.....
Johns-Pratt Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Pratt & Whitney Co.....com.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Pratt & Whitney Co..... pfd	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stillwell-Bierce Co.....com.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stillwell-Bierce Co..... pfd.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shultz Belting Co.....	100	500,000	.....	2 % Sept. 1, '97.	107	109	107	109	107	109	109
St. Charles Car Co.....	..	.....	.....	.....	85	90	85	90	85	90	90
* Unlisted.											

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.		Amount.		Due	Interest periods.	Bid.	Asked.	NAME.		Amount.		Due	Interest periods.	Bid.	Asked.
		Authorized.	Issued.					Authorized.	Issued.						
Albany, N. Y.								New Orleans La.							
Date of Quotation—Jan. 24, 1898.								Date of Quotation—Jan. 17, 1898.							
The Albany Ry. 1st mtg. 5s.	.....	.....	\$29,000	1905	.....	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	100 1/2	.....	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*110 1/2	.....	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100 1/2	.....	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....	.....	Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	78 3/4	.....	70
Waterfront Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117 1/2	.....	.....	New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1903	J. & D.	106	109	.....
Waterfront Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	.....	N. Ori's City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100 3/4	101 1/2	.....
Troy City Railway Co. 1st 5s	.....	.....	.....	.....	*105 3/4	106 1/2	.....	Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	108	.....	.....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.								Orleans Railroad Co. Cons. mtg. 6s. \$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$990,000 outstanding.							
Baltimore Md.								New York.							
Date of Quotation—Jan. 24, 1898.								Date of Quotation—Jan. 24, 1898.							
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113 1/2	114	.....	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90	.....
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	112	.....	.....	Atlantic Ave. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106 1/2	*108	.....
Baltimore Trac. Co. Ext'n. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	104	105	.....	Broadway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123	.....
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	115	.....	.....	Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	108	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	111	.....	.....	Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	111 1/2	.....	.....	Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	.....	.....
City & Suburban Ry. 1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	114 1/2	114 3/4	.....	Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	*107	.....
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	108 1/2	109	.....	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	115	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	116	.....	.....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	111 1/2	115	.....
\$151,000 in escrow to retire 1st mtg. bds.								Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	90	.....
Boston, Mass.								Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	100	103	.....
Date of Quotation—Jan. 24, 1898.								Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108	.....
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	8,702,000	1924	J. & D.	161 1/2	102 1/2	.....	Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	.....	80	.....
West End Street Ry. Deben. g. 5s.	8,000,000	8,000,000	1902	M. & N.	105	107	.....	Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	95	.....	.....
West End Street Ry. Deben. g. 4 1/2s.	2,000,000	2,000,000	1914	M. & S.	107	.....	.....	Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	106	108 1/4	.....
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.								Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115	.....
Charleston, S. C.								Central Cross-town RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122	.....
Date of Quotation—Jan. 24, 1898.								Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	105	105 1/2	.....
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....	.....	2d Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & J.	115	117	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....	.....	Dry Dock, E. Bd'y & Bat'y R. scrip 5 1/2	1,100,000	1,100,000	1914	F. & A.	100	*103	.....
Controlled by Charleston St. Ry. Co.								Elighth Av. RR. Co. Cert. indebt. 6 1/2	1,000,000	1,000,000	1914	F. & A.	100	.....	.....
Chicago Ill.								42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	119	.....
Date of Quotation—Jan. 24, 1898.								42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	93	.....	.....
Chicago City Ry. 1st mtg. 4 1/2s.	6,000,000	4,619,500	1901	J. & J.	102 1/4	102 1/2	.....	Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	121	.....	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103 1/2	.....	.....	Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	115 1/2	.....	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....	.....	Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	109 1/2	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....	.....	Second Avenue Ry. Deben. 5s.	300,000	300,000	1909	J. & J.	101	105	.....
Chicago & So. Side R. T. 4 1/2s.	1,500,000	750,000	1907	J. & J.	.....	.....	.....	Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	112	115	.....
Chicago West Div. Ry. 1st mtg. 4 1/2s.	4,040,000	4,040,000	1932	J. & J.	103	.....	.....	South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	102	107	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	.....	55	.....	Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123 1/2	125	.....
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51 1/2	52	.....	Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1906	J. & J.	.....	.....	.....
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	104 1/4	.....	Twenty-third Street Ry. Deben. 5s.	150,000	150,000	1906	J. & J.	103	108	.....
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	103 1/2	.....	Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104 1/2	106	.....
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	102 1/2	.....	.....	Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105	.....
North Chicago City Ry. consol. 4 1/2s.	2,500,000	2,500,000	1927	M. & N.	102 3/4	.....	.....	\$1,035,000 in escrow to retire gen. mtg. bonds. \$84,850,000 in escrow to retire maturing obligations. \$552,000 in escrow to retire 1st and 2d mtg. bonds. In treasury, \$80,000. Guar. by Union Ry. Co.							
West Chicago St. RR. 1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	101 1/2	105	.....	Toronto Canada.							
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	101	101 1/2	.....	Date of Quotation—Jan. 24, 1898.							
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	98	99	.....	Montreal St. Ry. 1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	.....	.....	.....
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101	101 1/2	.....	Toronto St. Ry. 1st mtg. g. 4 1/2s.	4,550,000	2,200,000	1921	M. & S.	.....	.....	.....
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chl. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.								\$35,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.							
Cincinnati, O.								Philadelphia.							
Date of Quotation—Jan. 24, 1898.								Date of Quotation—Jan. 24, 1898.							
Cin. New & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99 7/8	100 1/2	.....	Continental Pass. Ry. 1st mtg. 6s.	350,000	310,000	1909	J. & J.	.....	.....	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107 1/4	.....	.....	Empire Pass. Ry. 1st mtg. 7s.	300,000	200,000	1900	J. & J.	.....	.....	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....	.....	Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107 1/2	107 3/4	.....	Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	.....	1901	.....	.....	.....	.....
So. Gov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118 1/2	120 1/2	.....	People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....	.....
So. Gov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126	130	.....	People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....	.....
Assumed by the Cincln. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.								People's Pass. Ry. Cons. mtg. 5s.	1,125,000	367,000	1912	M. & S.	.....	.....	.....
Cleveland, O.								People's Pass. Ry. Stk. trs. cert. g. 4s.	5,698,210	.....	1943	.....	99 1/4	.....	.....
Date of Quotation—Jan. 24, 1898.								Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....	.....
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106	.....	Philadelphia Trac. Co. Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105	.....
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99 7/8	100 1/2	.....	Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1903	A. & O.	.....	.....	.....
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	109	103	.....	Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....	.....
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	105	.....	Union Traction Co. Coll. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	.....	.....	.....
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	.....	.....	.....	West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....	.....
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106 1/2	107 1/4	.....	West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115 1/2	.....	.....
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	90	95	.....	West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114 3/4	115	.....
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102	.....	The trust certificates were issued to pay for the shares of the Electric and People's Traction Lines purchased.							
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.											

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Jan. 24, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1903	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	104	106
Missouri RR. Co.....	1,000,000	700,000	1916	M. & S.	104	106
†Mound City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
†People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
†St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	300,000	300,000	.....	.....	60	64
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	110½	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Jan., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	107	....
Gary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126	....
†Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	....
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	....	101½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	....
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	115	118
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Jan. 24, 1898.						
Belt Ry. Co. ....C..... mtg 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....C..... mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home..... mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Jan. 24, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind. poll.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo).....1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	94	97
Consolidated Traction (N. J.).....1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	99½	99½
Crosst'n St. Ry. (Colu's, O.).....1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	94½	97½
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	101
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	.....	95
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	112	112½
†Minneapolis St. Ry.....1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	89	91
†No. Hudson Co. Ry. (N. J.).....Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.).....2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.).....Deb. 6s.	500,000	439,000	1902	F. & A.	116	.....
†Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
†Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	90	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of C. St. RR. Co.						
†\$87,000 in treasury.						
†\$950,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
<i>Date of Quotation—Jan. 24, 1898.</i>						
Edison Elec. Illuminating Co., Boston...	2,026,000	....	1922	Quar.	154	....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	....	160½	....
Pittsburg, Pa.						
<i>Date of Quotation—Jan. 24, 1898.</i>						
Allegheny County Light Co. 1st mtg. 6s.	500,000	....	1911	J. & J.	105	....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	....	1913	A. & O.	....	....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	....	....	M. & S.	....	....
Miscellaneous.—(Jan. 24, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	....	111	....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,160,000	1993	....	113	....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	....	110	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	....	....	....	103	....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	....	1909	A. & O.	....	....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	....	1921	Q'ry.	....	....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	....	....	....	75	80

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
<i>Date of Quotation—Jan. 24, 1898.</i>						
American Bell Telephone Co. 7s.	....	....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 7s.	....	....	....	....	108	....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	....	....	....	....	108½	....
Chesapeake & Potomac Teleph. Co. 5s.	....	....	1911	J. & D.	103½	....

ALLIED INDUSTRIES.

Miscellaneous.						
<i>Date of Quotation—Jan. 24, 1898</i>						
American Electric Heating Co. 5s.	500,000	500,000	....	....	15	19
Armington & Sims Eng. Co. 5s.	....	....	....	....	25	....
*Barney & Smith Car. Co. 10s.	....	....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co. 5s.	75,000	....	....	....	....	....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10½@10¾c.; Lake, 10½@11c.; casting, 10½@10¾c.

The Albany (N. Y.) Railway Company has declared a dividend of 1½ per cent., payable February 2.

The Chicago Edison Company has declared a quarterly dividend of 2 per cent., payable February 1. Books reopen February 2.

The American District Telegraph Company, Philadelphia, has declared a quarterly dividend of 1 per cent., payable February 15.

The Consolidated Car Heating Company, Albany, N. Y., has declared a dividend of 1½ per cent., payable February 15. Books close January 31.

The purchase of a single 100 shares of Edison Electric Illuminating of New York one day last week put that stock up 5 points, the transaction being made at 135.

The Dry Dock, East Broadway & Battery Railway Company of New York has declared a quarterly dividend of 1½ per cent., payable February 1. Books reopen February 1.

The Brooklyn Heights Railroad Company is seriously considering a change of motive power on its cable road from Fulton street to Wall street ferry. The underground electric system is under advisement.

C. S. Sergeant has been appointed second vice-president and Joseph H. Goodspeed comptroller of the Boston Elevated Company. These gentlemen were respectively general manager and treasurer of the West End Company.

It is reported that a new company is to be formed in Philadelphia for the purpose of getting control of all the electric light companies. The company is to have a capitalization of \$15,000,000 and will issue \$15,000,000 debenture 5 per cent. bonds.

Justice Maddox in the Supreme Court in Brooklyn, N. Y., has granted a formal order giving the Kings County Elevated Railroad permission to make connections with the Brooklyn Bridge in the manner proposed and approved by the bridge trustees.

Hon. J. D. Vandeman has been appointed receiver of the Electric Railway Company of Delaware, O. The road has an indebtedness of \$24,000 against it, which has given rise to discontent among the stockholders, and will be appraised and offered for sale at once.

The Montgomery (Ala.) Light Company's plant has been sold under a decree of the U. S. Circuit Court in a foreclosure suit. The property was bought by Bernard Kahn, Charles M. Slagle and Frank J. Hambleton of Baltimore, as commissioners of the bondholders, for \$258,900.

A semi-annual dividend of \$3.50 per share has been declared on the preferred capital stock of the United Electric Securities Company, Boston, payable May 2 to stockholders of record April 20, 1898. Transfer books close at the close of business April 20 and reopen May 3.

In the New York Assembly on the 18th inst. Mr. Sullivan introduced a bill for the regulation of prices to be charged for electric light in cities, the maximum charge to be three-quarters of a cent per light per hour for incandescent and 4 cents per hour for each arc light.

The Metropolitan Street Railway Company, New York, has completed the lease of the Second Avenue surface line. It had previously secured control of the stock by purchase of about five-sixths of it. The lease is for a long period, on the basis of 8 per cent. for the first three years and 9 per cent. thereafter.

The Olcott Reorganization Committee of the Brooklyn (N. Y.) Elevated Railroad gives notice that in pursuance of the plan of reorganization heretofore announced, a first installment of 25 per cent. of the amounts to be paid by the various security holders is payable at the offices of the Central Trust Company, 54 Wall street, February 7.

President William A. Gaston of the Boston Elevated Railroad Company outlined the plans of his company at the recent dinner of the Merchants' Club in Boston. He said the motive power will be electricity; that it will be gotten from a third rail; that the cars in a general way will resemble the cars in use in New York, and that the free transfer policy will be used generously.

A bill has been introduced in the Assembly at Albany to permit the Long Island Railroad Company to operate a surface line on Atlantic avenue, Brooklyn, after its present tracks are put underground. The underground system, according to a plan devised for the company, will connect with New York at Maiden Lane by means of a tunnel under the East River and be extended underground to 42d street in that city.

The Edison Electric Illuminating Company of Brooklyn reports gross earnings for December of \$93,657, an increase of \$11,497 as compared with the same month in the previous year, and net \$48,605, an increase of \$1,401. For the year ending December 31 the gross earnings were \$888,729, an increase of \$62,178 as compared with the corresponding period of the previous year, and net \$370,098, an increase of \$27,940.

The Chicago city council has now before it an application for a franchise from the Wisconsin Island Lakes & Chicago Railway Company, which proposes to construct a trolley railway from Chicago to Wisconsin lake resorts, and offers \$550,000 for a city franchise; another from the Chicago Central Electric Railway Company giving it a loop on the West Side with an entrance to the downtown districts, and a third from the Chicago City Railway.

In a recent interview Manager I. D. Barten of the Brooklyn (N. Y.) Elevated Railroad stated that published statements to the effect that electricity as a motive power was about to take the place of steam on the various lines operated by the company was somewhat premature. Such a thing was certainly in contemplation, but no contract had been signed or entered into although various plans had been submitted and were under consideration.

The Edison Electric Illuminating Co., New York, reports gross earnings for December of \$286,740, an increase of \$40,465 as compared with the same month of the previous year, and net \$157,410, an increase of \$24,291. For the year ending December 31 the gross earnings were \$2,492,371, an increase of \$244,933 as compared with the corresponding period of the previous year, and net \$1,267,230, an increase of \$172,880.

The Guaranty Trust Company informs holders of Atlantic Avenue Railroad Company (Brooklyn) 5 per cent. improvement bonds and Brooklyn, Bath & West End Railroad Company 5 per cent. general mortgage bonds that the syndicate formed for the purpose of participating in the readjustment of the bonded indebtedness and leasehold interests of the Nassau Electric Railroad and Atlantic Avenue Railroad Company having purchased more than two-thirds of the above named bonds at 85 and accrued interest, they are authorized to offer the same price to holders of any of the remaining bonds, provided they are deposited on or before February 1.

The Governor of New Jersey having declared the franchises of the Electro-Pneumatic Company forfeited, John I. Waterbury, William A. Dick and Bernard M. Baruch, at the request of the holders of a large amount of stock who believe that the patents owned by the company contain fundamental principles of pneumatic tube transportation, have consented to act as a committee to protect the stockholders' interests. Stockholders are requested to deposit their holdings, indorsed in blank, with the Manhattan Trust Company, under the terms of a protective agreement, paying to the trust company 20 cents per share to meet expenses.

electricity he will save the people whose water pipes are being destroyed by electrolysis a great deal of annoyance and expense. He may also so reduce the operating expenses of his company that the telephone rates may be reduced without impairing its handsome dividends. But perhaps the street car companies will object to supplying the Bell Telephone Company with electricity, and may discover that it would be a wise business move to put in a metallic circuit and save for their own use the electricity now wasted in the earth. In this event the street car magnates may find it possible to save enough to reduce fares.

"Merely as an exposure of a crude, wasteful and destructive method of handling electricity as a motive power, Mr. Durant's discovery is valuable."

As the last paragraph states, this discovery is principally valuable as showing the wasteful and inadequate methods adopted by the street railway companies in St. Louis.

* * *

New Method of Insulating an Electric Current.

As is well known, there is a limit to the distance electricity can at the present day be economically transmitted even at an exceedingly high potential, owing to the loss which occurs over long distances in overcoming the resistance of the conductor. The problem of conveying even a high potential alternating current, say 100 miles from the point at which it was generated, has as yet not fully been worked out. This is an all-important question, for if current could be generated at various points where suitable water-power was available, and then distributed far and wide throughout the country for manufacturing or lighting purposes, there would be an immense annual saving in fuel. This is what electrical engineers have been striving to accomplish for some time. An inventor in Chicago has recently devised a means of transmission which he claims will operate economically over any distance. His aim would seem to be not so much to reduce the actual resistance of a conductor as to prevent any loss through radiation or induction. Mr. Archibald J. Robertson, the originator of this method of insulation, makes the following statement regarding his device in a recent issue of the *Chicago Tribune*:

"With all deference to the promoters of the present lines of transmission carried on aerial supports, I will say that that system is at best but a makeshift. Further, I venture to assert that, even were it possible to transmit on aerial supports over great distances, which it is not, legislation in the various States throughout which such a line would pass would act against it as soon as legislators were made aware of the danger attending the transmission of heavy currents. Again, the cost of maintaining long lines on aerial supports would be so excessive as to render such lines uncommercial. It is admitted by all practical men that, for heavy currents, underground lines are preferable; but underground lines hitherto have been defective. Why? It is impossible to keep the conduit or duct which carries the conductor dry. Induction and loss of electric force are inevitable consequences. It is to this defect that I have devoted some time, money and thought, and this invention is the result."

The device consists in inclosing the electric conductor in a train of underground tubing of insulating material from which the air has been exhausted. This is to be accomplished by means of exhaust pumps placed from fifteen to twenty miles apart along the line. The duct, according to the inventor, should have an internal diameter of about four times that of the conductor. The latter is to be held in the center of the tubing by means of insulators spaced at short intervals apart. The tubing should consist, as previously stated, of insulating pipe in three-foot sections, and of two diameters to permit of their telescoping. The joints between the

inside pipes may be made to lie under the respective centers of the outside pipes or vice versa; in this way the outer pipe would afford a protection to the inner joint. The internal diameter of the outer pipe should slightly exceed the external diameter of the inner one, thus reserving a space for sealing. All the joints and spaces just mentioned are sealed with asphalt, which is poured in through an orifice left for the purpose in the outer pipes.

As can readily be seen this operation in a long line extending over miles of territory would be exceedingly tedious and entail an enormous amount of labor.

After the line is complete, the inventor proposes to exhaust the air from the conduit in the direction of the current. His object in so doing is to aid its progress, on the principle that wind aids the progress of sound waves. In order that the exhaust system should always be in the direction of the current, the duct is sealed around the conductor at each pumping station. This seal should be extremely thin and a good insulator. To allow of a constant suction an infinitesimal quantity of air would be admitted at each station by means of a trip valve. It is proposed to control the latter by a spring which would admit the air at a given pressure. The inventor's claim is that, by exhausting the air, there would necessarily be an absence of moisture, and consequently no chance of any current escaping from the conductor through radiation. It is further proposed to supplement this drying process by placing at frequent intervals in the conduit unslaked lime which, as is well known, is an absorbent of moisture. Regarding an electric conductor protected in the manner described, Mr. Robertson is credited with having made the following statement:

"An electric conductor under these conditions is absolutely dead to every outside impulse. I do not hesitate to assert my belief that such a line will transmit electricity any distance without the slightest loss."

This last statement would certainly seem to be a rather sweeping one. If the inventor means that there would be no loss through radiation or induction this might possibly be the case provided every part of the system worked in a satisfactory manner, but even then there would still be the line resistance to overcome, which would limit the distance to which current could economically be transmitted. Moreover, the whole arrangement is exceedingly complicated, and would require constant attention to prevent a leak occurring, the pumps from getting out of order, or some other unforeseen accident happening. The frequent renewing of the unslaked lime alone over a long distance would require considerable labor. When all these points have been taken into consideration, it will probably be found that the extra cost of labor such a system would entail would far outweigh any advantage this method might have over a well insulated cable for the transmission of a current. What is more especially needed is not so much a method of insulating the conductors now generally in use as the discovery of some new material or combination of substances with no greater resistance than copper at about one-fifth the cost of that metal.

The inventor of this pneumatic insulating device seems to think that his system would be especially applicable to mining operations in Alaska, enabling an electric current to be transmitted over any distance from natural sources of power. According to a press report, an Eastern company is now being organized with a capital of \$5,000,000 for the purpose of putting the Alaska scheme into operation. If such is the case, it might be well for any prospective investors to insist on a thorough trial of this system being made, say between Niagara and New York City, where climatic conditions would not materially enter into the problem, before embarking in the Alaska enterprise too heavily.

Electricity for Consumption.

A well known physician, Mr. J. Mount Bleyer, is said to have discovered a method of curing consumption by the use of an electric current. This system is as yet not thoroughly perfected, but the experiments he has so far made have been very successful, so it is claimed. Dr. J. Mount Bleyer made the following statement regarding his method, which appeared in a recent issue of the *New York World*:

"I claim that this is the most scientific and most important discovery since Koob's bacilli. It is destined to stay, and not like all the recent forms of treatment, which are only based on theoretical philosophy and not on pure physical laws. There is no pain whatever connected with the application of electricity, as a great quantity of current is used and distributed on a large surface of electrodes."

Dr. Bleyer's system is based on the well known principle that electricity can be made to act as a purifying agent by virtue of the ozone which it gives forth under certain conditions. Water and sewage have frequently been treated in this manner both in this country and abroad with excellent results. To cure consumption Dr. Bleyer has availed himself of this same principle, and revivifies the blood of a patient by giving it ozone. To accomplish this he places pads on the patient's chest directly over the diseased portion of the lung and a pad on the corresponding point in the back. Then a current of electricity at extremely high voltage is sent directly through the body for twenty minutes or half an hour. Regarding the voltage used, Dr. Bleyer says:

"I am not yet ready to say what amount of electricity I use, as I do not wish inexperienced professionals to make the experiment, with perhaps fatal results."

By this means the dead tissue of the lung, which is the cause of the disease, is said to be gradually destroyed and the patient gets rid of it by expectoration.

It has been proven by experiments on rabbits that the electric current really revivifies the blood by giving it ozone. Advanced stages of this dreaded disease cannot be cured by the application of electricity, but it is claimed that such patients as possess certain vitality and enough of the lung substance to carry the physiological processes are susceptible of an absolute cure within a reasonable space of time by the daily application of the current.

Any means that can be devised for successfully combating this terrible disease will unquestionably be of inestimable value to humanity.

Under the Searchlight.

Notes and Comments on Various Topics.

Bernstein Electric Co.

As we went to press last week we were advised that the Bernstein Electric Company of Boston had made an assignment, but before stating the fact we were anxious to present to our readers some sensational developments regarding this concern and its actions. As is well known, this company confined itself almost exclusively to the manufacture of incandescent lamps under patents of Mr. Bernstein. As far back as the Franklin Institute Exhibition in Philadelphia in 1883, Mr. Bernstein had been making more or less progress in the direction of lamp manufacture, but the product of his factory did not attract commercial interest, due to the fact that the lamps he made were mostly of high candle-power and were unsuitable to the uses of the trade generally; they were, however, used to some extent for series lighting.

In 1888 the present company was incorporated with a capital stock of \$100,000, and the plant was mortgaged in 1889 for \$100,000. At about this time Mr. Henry B. Cram became general manager and Mr. Charles A. Coffin and others of his following were

interested parties. Shortly afterward the Bernstein Electric Company manufactured a brand of lamps for the Alexander, Barney & Chapin supply house which was known as the "A. B. C." brand. With the failure of the Alexander, Barney & Chapin Company the Bernstein Electric Company lost a valuable customer, and in spite of all the hustling Mr. Cram could do the company did not prove a financial success. The manufacture of small fan motors was then taken up, but this too proved unsuccessful, and after a varied experience Mr. Cram retired from the management a little over a year ago, and was succeeded by Mr. Bradley, who also retired as manager a few days before the company's failure. There are many ugly rumors afloat regarding some of the inner transactions of parties interested in this company. The Lamp Pool by reason of this failure loses one of its members. An attachment from Steuben County against the Bernstein Electric Company of Boston for \$1,459, in favor of the Corning Glass Works, is in the hands of the sheriff, and others will doubtless follow. We wonder what explanation Mr. Coffin will have to make for the collapse of one of his pet concerns.

As the Count of Monte Cristo says at the disappearance of his first enemy—"One." Who will be the next of the unpopular Lamp Pool?

* * *

Stockholders Growing Restless.

(From the Boston Advertiser.)

There continues to be much newspaper talk respecting the plans of the General Electric management in connection with the back dividends due on the preferred stock. According to late gossip, enough is known about the business of the company to warrant the assertion that it has enjoyed a prosperous year, and that its earnings above charges are sufficient to justify payment of dividends on both the preferred and the common shares.

The company owes about \$1,265,000 accumulated dividends on the preferred stock, and until this amount is paid off nothing can be distributed to the common stockholders. The company for some time has been buying its 8 per cent. debenture bonds in the market, until it is now said to hold about \$2,000,000 of them in its treasury. These bonds, it is declared, have not been cancelled, but are held as assets and could be reissued if desired.

In these circumstances the preferred stockholders are decidedly restless, and insist that it is time for the company to clear off its obligations to them. The common stockholders are likewise impatient at a policy which blocks the way to a resumption of dividends on their holdings. The preferred stockholders have received nothing since January, 1894, and nothing has been paid on the common stock since August, 1893. Both classes of stockholders have received promises from the management that some disposition would be made of the accumulated preferred stock dividends as soon as the times warranted it.

Great pressure is being brought upon the company's managers to take action, as the finances and outlook of the company are believed to justify such a course. It is said by some persons who claim to be acquainted with the affairs of the company that it is now so well supplied with business contracts that it may not deem it desirable to compete actively for any of the preliminary contracts for the electrical equipment of the elevated railroads.

The company's management considers it wise to conserve its present cash surplus, but there is a willingness to cancel the back dividends on the preferred stock by the reissue of debenture bonds held in the company's treasury. It is confidently expected by certain large interests in General Electric that this plan will be definitely formulated within a short time.

That is certainly rich. The General Electric Company doing such a large amount of business that it really does not care to compete actively for any of the preliminary contracts for equipping the elevated roads with electricity! This statement must either have been made with a view to forewarning their stockholders, so as to lessen their disappointment at their not getting it, or because, with the shadowy margin of profit this concern usually allows itself, they are afraid of losing too much on the contract. Not to want a thing that one can't possibly get is a spirit that is always to be commended.

* * *

We now hear of a man who prides himself on having at three different times received a shock from a 1,000-volt alternating current—one of which lasted

twelve minutes—without any evil effect resulting. Were all persons built on this same plan, some other method of executing criminals would have to be devised for the State of New York.

* * *

Power for the Whole World Except Philadelphia.

We take pleasure in publishing the following communication from a correspondent, and as we failed to have it copyrighted have no objection to some of the dailies copying it provided credit is given:

Editor ELECTRICITY.

I wish to inform the Universe that I have made the most important discovery of the 19th century. It is not my intention to patent it, but to give it to the world free of charge, and my object now is to let everybody know of my discovery, in order to prevent unscrupulous persons from stealing and patenting it, and thus depriving mankind of its benefits.

I have found by a scientific calculation that every cubic mile of heated matter of the earth's interior contains enough heat to supply twenty million horsepower for a year, or the equivalent of 400 million tons of coal. My discovery came about in this way. One day I was sitting and thinking, that is, my mind was in a rapid train of thought. I was trying to find some way to prevent the destruction of the human race by the constant increase in the percentage of carbonic acid in the air, due to the burning of so much coal, which I am told by scientists will in a few hundred thousand years make the oxygen so scarce that it will be only within the reach of millionaires who live in sky-scrapers.

While pondering on this momentous question, an idea suddenly struck me. I saw all at once that Nature had put this inexhaustible store of energy in the earth for the special use of man. All it needs is a five-million dollar syndicate to tap this great reservoir and supply the whole world with power. I would undertake the construction of the plant at a reasonable salary. My idea is to run copper and iron wires, a foot in diameter, from the equator to the north pole through the great centers of population. By soldering the copper wires to the north pole and the iron wires to the equator we could get a powerful thermo-electric battery, the center of the earth being the hot junction and the polar region being the cold junction. The central part of the earth, being composed mostly of metals whose average density is 5.5, would have very little resistance. These wires could be tapped for electricity at any point between the equator and the pole by connecting the motor or other translating device between a copper and an iron wire. It might be possible to dispense with the iron wires altogether and use the ground instead. With a few hundred of these wires running from the equator to the pole and properly distributed over the earth's surface, we might use electric heat to thaw out the frozen plains of Siberia and British America, thus bringing the Klondike into a temperate or even into a torrid zone. The vast snow-covered plains of America and Asia would become fields of verdure, supplying food and raiment for teeming millions of people.

I am aware that certain quasi scientific critics would object that this would use up the internal heat and cool off the earth so that it might become uninhabitable sooner than by the depletion of oxygen going on at the present rate. But I have another idea that provides against this difficulty. The great frozen deserts of Asia and America could be utilized to raise corn-pith cellulose enough to surround the whole world with a shell ten feet thick of this admirable non-conductor of heat. This shell could be built in sections and held up by a suitable system of iron towers, and covering the whole earth it would practically prevent all loss of heat. It is known to be a scientific fact that all electricity is eventually changed into heat, and under this non-conducting shell of corn-pith we could live without the aid of light and heat from the sun.

I would like to add that my plans have been care-

fully examined by experts with a big E, who admit that the system could be made to reach and supply all parts of the northern hemisphere except Philadelphia, where I am told the United Gas Improvement Company will continue to supply light, heat and power for all time to come, using chloride accumulators and Bates thermic engines, with corn-pith cellulose to burn. Yours very respectfully,

Menlo Park, N. J.

W. IZARD, JR.

P. S.—My father was also a great man in his day.

* * *

Altogether the year 1898 could hardly look more promising. We are in "bull" times, and while reactions will occur when the market becomes temporarily overbought, the power to absorb stocks, already in evidence, will increase as speculative sentiment broadens.—*Boston News Bureau.*

The fact that we are in "bull" times cannot well be disputed, otherwise some stocks that are practically worthless would not be quoted at what they are. In the case of the General Electric Company the purchasers of their securities absorb the stock all right while others absorb the dividends—when there are any. Their principle apparently is that a fair exchange is no robbery—you take the rind and I take the core.

* * *

We reprint this from the New York World, with apologies to Mr. Edison:

The world does not know that in addition to possessing an inventive genius to a remarkable degree, Thomas A. Edison has also a keen sense of humor. Those who know the Wizard best are aware that he is ever ready to listen to a good story. Edison himself has said many things that are worth repeating, as is indicated by the following:

A number of buildings in Orange, N. J., had been struck by lightning. Some of the deacons of a local church feared for the safety of the edifice in which they worshipped, and suggested that the church building be equipped with lightning rods. Others among the deacons opposed the suggestion, on the ground that lightning rods were of no practical value.

The discussion resulted in one of the deacons, a pompous individual, being appointed a committee to learn all he could on the matter and report. The deacon decided to interview Edison, as the latter was an unquestioned and high authority on matters electrical.

Edison was very busy when the deacon called and insisted on seeing him.

"Mr. Edison," the deacon began with a flourish of his hand, "I don't believe lightning rods on a building are of any value, do you?"

"What sort of building?" asked the Wizard, impatient to be away.

"Well, on a church for instance."

"By all means," answered Edison quickly. "Providence is absent-minded at times."

The Stanley Electric Manufacturing Company.

The annual meeting of the Stanley Electric Manufacturing Company of Pittsfield was held last evening and the reports were gratifying. The business of the past year has been very prosperous, and for a good part of the time their extensive shops have been run overtime. The shipments show a decided increase over last year, or about 12½ per cent., and more orders to begin the new year with than they have ever had before. The gross profits for the year are reported at over \$100,000. A dividend of 6 per cent. was declared, payable April 1 to stockholders of record January 25. The stock is quoted at 130. The Stanley Company's machinery sells for a higher price than any other similar concern's of the class that is made, and the payroll is about \$3,000 a week.

Pittsfield is pleased with the prosperous company in its midst doing a business the past year of about \$600,000. The old officers were elected as follows: President, W. W. Gamwell; treasurer, George W. Bailey; general manager, John H. Kelman; general superintendent, Henry Hine; electricians, C. C. Chesney and John F. Kelly; directors: William W. Gamwell, William A. Whittlesey, William R. Plunkett, Walter F. Hawkins, Henry Hine, George H. Tucker and George W. Bailey. The company's machines are in active demand, going to foreign countries, including Japan, and four large ones were shipped to California yesterday. The company also maintains a large shop in Canada for English and Canadian trade.—*Springfield Republican, Jan. 26.*

THE PRESENT EFFICIENCY OF INCANDESCENT LAMPS.*

BY JOHN E. RANDALL.

The present efficiency of incandescent lamps for central stations lies somewhere between 3 watts per candle-power and $3\frac{1}{2}$ watts per candle-power. It might appear from these limits that no advance has been made in the lamp industry during the last thirteen or more years of its extensive growth. As long ago as 1885 we heard of $2\frac{1}{2}$ watt lamps, and $3\frac{1}{2}$ watt lamps were considered a regular article of commerce. At the Detroit meeting of the National Electric Light Association in 1887, a $1\frac{1}{2}$ watt lamp was described. As no one in the business is advocating longer life than was claimed ten years ago, it would appear from the figures named above as if the manufacture of incandescent lamps had retrograded and was approaching the state of a lost art.

If the falsity of this supposition were not demonstrated every night, one might be pardoned for thinking the industry was disintegrating.

Every investigation of claims for extremely high efficiency has shown that there was some hocus-pocus—either the candle was of the wax taper variety or the watt was not one of the family that James made famous, or else the lamps didn't live to tell the tale.

Finally the people forgot about the 1 watt and the 2 watt lamp, and concluded to take what they could get, which might be anything from 3 watts to 5 watts, depending upon what the maker had ready to send. It really was a matter of small moment whether the lamps were 3 or 5 watts per candle, since they all went to 5 watts the next day after they were placed in circuit.

This state of affairs has continued with some improvement until a comparatively recent date. In the meantime elaborate series of life tests were made under the auspices of the Franklin Institute; Mr. W. H. Pierce made an extended test; several foreign tests appeared, and tests were made at the Ohio State University of samples from thirteen different makers. There was nothing promising in the general results of all these tests, and for a time the outlook was rather gloomy. Progress was being made however, although the results were not published. It was found that lamps whose initial efficiency was less than 3 watts per candle-power would not last a reasonable time on commercial circuits. This set the maximum limit of efficiency. The minimum was set by what the people would accept and it was placed at 4 watts. More recently all energies have been exerted to produce types suitable for the various kinds of uses. We have now the highly efficient central station lamp, the isolated plant lamp, and the railway type, besides numberless modifications for special uses.

Among the lamps in the Franklin Institute tests was one Weston tamadine (16) that maintained its brilliancy and gave most excellent life. It was the only one of the type, and almost the only one in the test that gave any indication of good quality as quality is gauged at present. As far as that test went the tamadine lamps were a commercial failure, yet this one lamp showed what might be gotten from a cellulose filament. Since then the cellulose filament has been brought to a degree of perfection far surpassing the prototype. While made by a process differing from Mr. Weston's, the present filaments possess all the good features to be found in this early lamp and have outgrown most of the poor ones. Upon the quality of this cellulose filament I base a claim that the present efficiency of incandescent lamps is better than it ever has been, and is so much better that the lighting industry is to be congratulated.

The incandescent lamp is still a filament of carbon of high resistance, hermetically sealed into an exhausted glass globe, with conducting wires passing

through the glass. Its quality as an illuminant depends directly upon the quality of the filament and the quality of the vacuum.

The object of the vacuum is three fold :

1. To reduce the energy expended per unit of light emitted, because of the heat lost through convection.

2. To prevent injury to, and destruction of, the carbon by burning.

3. To prevent injury by abrasion or so-called "air-washing."

Any gaseous envelope will carry away the heat-energy from an incandescing body so rapidly that a great amount of power must be supplied to maintain its surface at a temperature corresponding to a certain brilliancy, the core being at a far higher temperature. This loss becomes less as the pressure of the surrounding gas is decreased, until a point is reached beyond which no further changes can be detected. When the vacuum reaches one part in 1,000 the loss becomes extremely small, and after a vacuum of one part in 10,000 is reached the loss is negligible so far as our present methods of measuring light can determine.

Some years ago we made a series of measurements showing the relation between the degree of vacuum and the power necessary to produce a definite candle-power from a lamp filament. The net results showed that, so far as the convection losses are concerned, the degree of exhaustion ordinarily found in incandescent lamps is better than need be.

Carbon at high temperature cannot resist the attacks of oxygen. Therefore all oxygen must be eliminated, even slight traces causing injury to the carbon surface. We would naturally suppose that the residual gas was composed of oxygen and nitrogen, in the proportions found in air. The induction coil shows that such is not the case, and I believe that in a properly exhausted lamp, although no other gas may be purposely admitted to displace it, no oxygen remains. It is known that a filament will rapidly decline in brilliancy if the vacuum is low, because the radiating surface is injured, but it will not burn out. Very few lamps burn out because of poor vacuum unless cracked, when, of course, fresh oxygen is constantly admitted.

While the effects of abrasion formerly were considered of importance, my experience indicates that, at present at least, they are of small consequence. A high degree of exhaustion, as measured by a vacuum gauge, is not the object to be attained; an unchanging vacuum is essential to the maintenance of the highest brilliancy. In the type of lamp made five years ago a positive injury resulted if the vacuum were made too high. The disintegration of the filament, due to evaporation of carbon, not only injured its surface but seriously darkened the bulb.

The vacuum does not grow poorer with age provided the lamp is properly made and exhausted in the first place. The vacuum changes as the lamp is burned, and a part of the lamp maker's art is to reduce these changes to the smallest degree. But the vacuum is finally higher than at the start. Nothing is tighter than the glass and wire joints of a properly made incandescent lamp. Absolutely no leak can be detected after years. In some lamps used for at least twelve years in rheostats where the current at times brought them to full brilliancy the vacuum was as good as when first made.

Many think that all lamps gradually lose their vacuum. This mistaken notion was caused, no doubt, by a fault common to many individual lamps having the old form of seal at the base, and illustrates the influence which apparently unimportant details exert upon quality, as well as the necessity for wide information and extended experience in successfully making lamps. The present lamps, made by modern methods, have perfect joints, or else the leaks are so bad as to be instantly discovered by proper inspection.

The filament is the most important element of the lamp, so far as efficiency is concerned. Filaments

are now made from a form of cellulose reduced chemically to an amorphous state.

Not many years ago, when the bamboo carbon was supreme, we had occasion to complain about the poor quality of a certain lot of bamboo strips which we had received from an importing firm. They said they could not guarantee a natural product. This furnished the key to the success of the cellulose filament. Art replaces nature, breaking down the structures of a fiber, reducing it to a protoplasmic condition, then spinning a thread radically different in appearance and character from the original material. Instead of whittling down a stock to make a lamp filament, we now cause the filament to grow.

The quality of the filament is determined by the thread. The process of squirting threads is controllable if proper skill, experience and appliances are employed. Yet the weather is more controllable than is the quality of the product when any of these requisites is lacking. It is easier to shave down strips of bamboo to a uniform size, or to weave braids of silk fibers that will appear to be even than it is to squirt a cellulose thread of uniform diameter, but the bamboo strips and the silk braid will not be uniform in weight. They cannot therefore make uniform carbons.

It may be supposed that the coating of carbon applied in treating the filaments fills up the pores and depressions, thereby correcting the defects due to irregularities in texture and surface. This is not true. A poor base carbon cannot make a good lamp. When one filament is found to be better than another, its superiority can be attributed to the base carbon.

In purity, density, surface polish and uniformity, the features that determine quality and maintain efficiency, the cellulose filament, properly made, far exceeds any other kind.

A graphitic coating covering an amorphous carbon body, in a vacuum, is, so far as known, the best combination for fulfilling these conditions. The science of lamp making consists in knowing how the carbon body can be formed, how the graphitic coating can be given and how the vacuum can be produced. The art of lamp making consists in doing these things perfectly and uniformly a thousand times over every day.

Whenever lamps are found to be uniform in voltage and efficiency they are found to be good. In all their minor features recently made lamps are superior to those of older dates. They are uniform in shape and neater in general appearance. The caps are securely attached and more durable in every way. They are entirely fireproof and nearly moisture proof. The bulbs are clearer, cleaner and alike in shape and size. The carbons are placed in the bulbs so as to be more effective and more symmetrical. The connections, both within and without the bulbs, are more secure. Cracks and poor vacuums have about disappeared.

These features help the service that can be derived from the lamps. They form part of the general economy of operation, and therefore influence the efficiency to the extent of being more satisfactory and reliable.

Another point worthy of consideration is the evolution of types suitable for the different conditions of service: one for close regulated central stations, one for poorer regulation and isolated plants in general, one for street railways and other purposes in which, for certain reasons, the service is severe. Added to these are the almost innumerable varieties for special uses, such as window decorations and signs. Finally the use of cellulose has made the 220-volt lamp a commercial possibility.

It may be claimed that the new lamps are more delicate than the older bamboo, in that they cannot be run as long before the filament will break.

The principle upon which all practical methods of illumination are founded, that of incandescence—excessive activity—limits the period of effective ser-

* Paper read before the Northwestern Electrical Association, Milwaukee, Wis., January 19-21, 1898.

vice and induces early destruction. We may as well accept the condition of limited life in the case of the incandescent lamp, knowing that no other light is better in this respect if all factors are considered.

I am not willing to admit that the cellulose filament is more delicate, either in transit or in service. Under identical conditions it will live longer than any other form of filament. Furthermore, the individual life approaches nearer the average than has been the case with any other material. Any carbon filament which will not maintain its brilliancy should live to a good old age.

The life of cellulose lamps at three watts per candle-power should not be compared with bamboo or silk at four. The four watt cellulose railway lamp is giving more satisfactory service than those of other materials. Their light is more uniform and they last longer.

Recent lamps are approaching the ideal one which, when its work is done, breaks and thus announces its own "smashing point." The best proofs of any claim are those based upon actual performance. In support of the claim that the present efficiency of incandescent lamps is more satisfactory than the past, I submit some comparisons.

In the subjoined table are results of tests made

end of the period. For example, if a cellulose lamp whose candle-power is 16 at the start and whose economy is 3.2 watts per candle-power is in service for 500 hours, it will average 15.17 candle-power during that period, but will give less than that value at the end. If a 50-volt bamboo lamp of the same brilliancy and economy is used for the same length of time, its candle-power will average 14.2. The 110-volt bamboo will, under the same conditions, average only 10.4 candle power. In the latter case especially the great change in the brilliancy of the lamps after they had been running for a short time would be very noticeable. Viewed in another way: If a station furnishes a service of 50 cellulose lamps to one customer, and to his neighbor a similar number of 110-volt bamboo, charging the same for each service, the one would be justified in demanding that his lamps be renewed every 100 hours in order to keep his place as bright as his neighbor's.

A 50-volt bamboo lamp, to maintain the same average brilliancy as the 3.2 watts cellulose during any period from 300 to 700 hours' service, should have an initial efficiency of 3.4 watts per candle-power. A 4-watt 110-volt bamboo would not maintain its brilliancy as well as a 3.2 watt cellulose.

While none of the lamps involved in the tests

ELECTRICITY IN MUNICIPAL ENGINEERING.*

BY PROF. R. B. OWENS,
University of Nebraska, Lincoln, Neb.

My object in presenting this paper is to emphasize the economy which can often be effected by generating at one point all the power required by a municipality, and its distribution for whatever purposes, by electrical means.

But I am not to be understood as advocating the community ownership and operation of any interest which can be as well administered by individuals. On the contrary, I believe the vicious efforts, so noticeable of late, to shift individual responsibility to that popular misconception, "the Government," marks the beginning of another serious setback to the growth of democratic institutions.

However, I will not attempt a discussion of private versus public ownership, even the phase presented by the lighting question. I only wish to show the economy of combining the several problems in municipal engineering involving the use of power, and to point out a further considerable field for the use of electrical apparatus.

The several principal problems referred to are, of course, the supply of water for potable and other uses, the disinfection and disposal of sewage, the destruction of ash-bin refuse, and street lighting.

When a city is so fortunate as to be able to get good water from a nearby river or lake, with or without pumping, much that I have to say will not apply. But in the majority of cases in our flat western country water is only obtainable from wells, driven or dug, and when a considerable amount is required, as for municipal uses, it is generally necessary to separate the wells as far as practicable, because of the limit to the supply which can be continuously obtained per unit of volume of water-bearing strata.

In small towns of a few thousand inhabitants, where the underflow is good, it is usual to find driven wells ten to twenty feet apart and a direct-acting steam pump over each, an arrangement which as a rule requires the construction of a railway siding for rapid coal supply. In cases of this kind I have recommended power pumps driven through a countershaft by an engine of economical design. To the same countershaft one or more dynamos can of course be attached. Now if both dynamos and pumps are driven by clutch pulleys, it is possible by shutting down pumps as dynamos are started, and varying the number in operation as lighting load varies, to keep an almost exactly constant load on engine—the most favorable condition for its economical operation.

In larger towns of from fifty to sixty thousand inhabitants and upwards, it is not unusual to find half a dozen pumping stations from one-half to one mile apart, each with a full complement of boilers, steam pumps and attendants, and the whole operated apparently as much in the interest of the coal dealers and those on the pay-roll as for the taxpayers. A one or two cylinder pump without flywheel, lifting from a single dug well and discharging directly into the mains, is usual.

In a case of this kind recently coming to my notice, I urged the immediate substitution for the steam pumps of an equal number of triplex power pumps operated by constant torque variable speed motors, the current for such motors to come from a central power plant equipped with economical machinery and suitably located.

The annual saving as the result of such a change was estimated to be more than 50 per cent. of total cost of operation. It might be remarked here that the recent appearance of satisfactory constant torque motors, in both A. C. and D. C. types, for operation from constant potential circuits, removes the last difficulty in the most general application of electric power, and now it can be confidently hoped that

* Paper read before the Northwestern Electrical Association, Milwaukee, Wis., January 19-21, 1898.

Average C. P. and Watts per C. P. of Bamboo and Cellulose Lamps During Various Lengths of Burning.

		During a run of—							
		0 hour.	100 hours.	200 hours.	300 hours.	400 hours.	500 hours.	600 hours.	700 hours.
Average C. P.	Cellulose— 110 volts.	16.0	15.89	15.86	15.68	15.41	15.17	14.96	14.74
	Bamboo— 110 volts.	16.0	14.1	12.9	11.8	11.0	10.4	9.9	9.6
	Bamboo— 50 volts.	"	15.8	15.8	15.0	14.6	14.2	14.0	13.7
Average watts per C. P.	Cellulose— 110 volts.	8.16	8.26	8.13	8.37	8.53	8.51	8.54	8.74
	Bamboo— 110 volts.	2.20	3.50	3.80	4.08	4.32	4.58	4.75	4.90
	Bamboo— 50 volts.	3.20	8.28	3.37	8.45	8.53	8.61	8.67	8.76

upon three classes of lamps: 1st, 110-volt cellulose; 2d, the 110-volt untreated bamboo; 3d, the 50-volt treated bamboo. The initial watts per candle power were nearly 3.2 for all. The bamboo represent their class, both the 110-volt and the 50-volt having been carefully selected. The tests upon these were a part of a series upon a large number started in groups of various initial watts per candle, and their results are consistent with those of the entire test. The tests were carefully conducted with the best facilities. They may be considered reliable. Both lamps were at one time extensively used and well regarded.

The figures shown for the cellulose lamps are the combined results of a number of tests made at various times and places and by different persons, but evidently made under similar conditions so far as regulation is concerned. There is excellent agreement, not only in averages but in individual cases, both in candle-power and in watts per candle-power. The oldest tests, which were made over three years ago, show the poorest results. This fact suggests a gradual improvement in the quality of the cellulose lamp. All the lamps entering the tests were samples of commercial lamps taken at random from large lots. No claim is made that the results are remarkable. I believe that they can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central station use.

The remarkable feature is the close agreement between various lots made at different times. This feature is the criterion of quality. Upon it depends the successful introduction and use of the highly efficient lamp. I believe that they can be relied upon to represent faithfully the present efficiency of the incandescent lamps supplied for central station use, because every result was used in the table, whether good, poor or indifferent.

This table shows the mean C.P. during a certain period of service, and not the value found at the

failed before 600 hours, no other conclusion has been drawn from this fact than that the percentage of early failures of lamps, operated under good condition, is so small as to be negligible.

Lamps are to-day more uniform in wattage; a variation in current of 2 per cent. either way from the average, is rare. Candle-power is tested while the lamp is revolving. Thus the true horizontal value is determined. The value of light standards is carefully guarded and constantly checked. The accuracy of all instruments employed in the photometer room is kept at the highest degree. While an official standard of C.P. does not exist, this fact has not caused the great divergence in the light value of different lamps. The most prominent manufacturers are in agreement as to the value of the 16 C.P. lamp. Their standards check more closely than do those of the technical schools. Lamps vary in C.P. because of carelessness and sometimes deception in rating. In the Columbia factory the accuracy of rating is considered a matter of prime importance and constant effort is made to keep the standards exact. Each lamp has a mark whereby its history may be known. The volts at which it gives its normal revolving horizontal C.P. together with the current passing are marked upon a suitable label. A record of these items for each lamp is made at the same time upon a sheet. These sheets are the indices of uniformity in the product.

One of the largest alternating stations in the country has, by substituting the highly efficient cellulose lamp for the low economy silk and bamboo, and by improving its regulation, been able not only to reduce the price of service to its customers, but to increase its lamp capacity over 25 per cent.

There is still one condition to be fulfilled in order that incandescent lighting may be more profitable—the voltage at the lamps must be kept everlastingly and unceasingly steady. There has been improvement, but much more is possible and desirable. Everything about lighting service is improved where regulation is improved, even the customer's temper.

non-expansive steam-working, as in boiler feed pumps, drain pumps, etc., in our lighting and power plants and also in many cases of pumping from wells against a constant head for city and other supply, will soon become a thing of the past.

The demand for water not being constant during the day, a suitable reservoir should always be supplied of such a capacity as not only to allow the engine or engines to operate at constant load but also to supply the extra water for fire purposes whenever it is required. Such a reservoir, though indicated by economy, is often lacking, in whole or in part; and more unfortunate still is the too small size of mains usually employed, the latter necessitating in some cases that the pressure at the pumping stations be more than doubled during a fire to obtain normal or approximately normal pressure at points where fire engines are attached.

These faults, however—the absence of suitable storage capacity and too small pipe—belong to the original design, and have nothing to do with the kind of power used for the pumps. But their absence will of course be seen to greatly facilitate the economical operation of a combined plant, one intended for the utilization of ash-bin refuse, the supply of power for pumping, for disinfecting of sewage and for street lighting.

The usual method of handling sewage is by means of a water carriage system—draining into the nearest stream without disinfecting. But this practice is barbarous. No system of sewage is complete which does not abstract the solid matter and sterilize the liquid portion before turning into our waterways.

The solid matter is readily precipitated as "sludge" in settling pools, and the clear affluent subsequently treated, or not, as the case may be. The sludge can be dried and pressed to about one part by weight of water and one part by weight of solids. This pressed sludge amounts to from one to two cwt. per annum per head of population, according to recent statistics. At first it was thought to have a high fertilizing value, but I believe it is generally recognized now as being useless for such purpose.

It has, however, more than sufficient calorific value to evaporate the water it contains and to destroy itself, and so may profitably be mixed with ash-bin refuse and used for fuel.

Chemical methods of sewage disinfection, when effective, are expensive, and it would seem that electrical methods must supersede them in the future. The two principal methods of manufacturing a disinfecting fluid by electricity are Hermite's and Woolf's, the former being used principally on the Continent and the latter in this country. They do not differ much except in detail. In both systems the disinfectant is obtained by passing a large current of electricity at low pressure through sea or salt water prior to or after being mixed with the sewage. From this results the formation of certain hypochlorites, hypobromites, and iodine compounds, which latter are for the most part in the form of iodates, all strong oxidizing agents directly or indirectly.

Where a common drainage and sewage system is adopted, the disinfecting liquid may be greatly diluted during a storm, but the trouble is obviated by the adoption of separate systems or by the use of a reservoir holding a considerable quantity of the liquid to be discharged into the sewage system in times of heavy rains.

One installation of the Woolf system reported consists of a 15 HP. engine with suitable dynamo, tanks, etc. A bacteriological examination made by competent persons showed almost perfect sterilization. This plant is considered sufficient for disinfecting the sewage of 30,000 population if run continuously.

At usual rates for fuel and attendance, the cost per inhabitant per annum was shown to be about twenty-five cents. A similar cost per inhabitant has been obtained elsewhere.

It will be seen, however, that this figure can be reduced to a small fraction of itself if the system

were operated as a part of a combined plant instead of as a small separate one. As compared with other systems of sewage purification, chemical, land filtration, or a combination of chemical and land systems, the cost per inhabitant per year by the electrical system, even when current is supplied from a special plant, is apparently less by from one-half to two-thirds.

Another important point to note in this connection is, that the electrical system while cheaper and in general more effective requires power at practically a uniform rate, a condition fitting in very perfectly with the economic operation of a pumping plant and the requirements of a plant to burn and utilize town refuse.

The matter of disposal of ash-bin, or more generally town, refuse has not received the attention it deserves. There is but one successful method of handling it, and that is, to burn it; but town refuse has a calorific value equal to about one-fifth that of ordinary coal, and consequently may become, with proper arrangements for its burning, a source of profit instead of an expense.

A difficulty in utilizing the heat energy of town refuse for street lighting is that it requires to be burned at a very regular rate the twenty-four hours. To meet this, the so-called thermal system of energy storage has been devised, but since the power required for pumping, supposing some reservoir capacity in the water system, and for the electrical purification of sewage, is in many cases practically constant, and more than that, obtainable from the refuse, a combination plant would save the expense of such a thermal system and accomplish as much.

It has also been proposed to use such a thermal storage scheme in connection with lighting plants having a poor load factor, but it may be seen that the following scheme is equally effective and involves very small extra cost. Instead of using separate thermal storage tanks, by carefully lagging the entire boiler setting and providing removable insulating covers for the fire and ash-pit doors, the boilers themselves may be converted into heat reservoirs. When one boiler of a battery is to be put out of service, the fire is allowed to burn as low as possible and the boiler well filled with water, then the fire and ash-pit doors are closed and covered, and the main steam valve to header shut tightly, as well as damper in smoke flue. Any further steam generated by the remaining fire on grate and by heat of setting finds its way into the header through a by-pass about main steam valve. In this by-pass is placed a difference of pressure valve to operate whenever the boiler pressure exceeds the pressure in the header by a certain desired amount. The rate of loss of pressure or heat by such an arrangement can be reduced to an extremely small quantity. Now when the boiler is to be put in operation again it has a pressure equal or perhaps greater than that of those in service and brings to their immediate aid its volume of stored energy on a sudden demand for steam. By providing arrangements for starting fires with oil when necessary, the stand-by boilers in a battery can be put into full operation at the rate of perhaps one a minute, or in any case quickly enough to meet such sudden demands for steam as can occur in practice. I have recommended such a method of handling boilers in small city pumping plants, where, during the time steam is not required for pumping for ordinary purposes the fires are banked for quickly getting up steam in the event of a fire. This scheme would save practically all the coal required for banking and which occasionally amounts to nearly one-half of all coal used.

Ash-bin refuse is burned in a special furnace, usually with automatic attachments for uniform feeding. These furnaces, though commonly called destructors, might better, as has been suggested, be called utilizers. In Great Britain there are more than fifty towns in which destructors are at present used. In this country, unfortunately, there are few.

By burning, the refuse is reduced to about one-

third of its weight and one-fourth of its bulk. The residue after combustion consists of clinkers and ashes which are valuable for road-making ballast. In the earlier forms of destructors the temperature was not high, but in more recent ones, designed to be odorless, the temperature of the gases is 1,500 to 2,000 degrees F., and the addition of a suitable boiler to absorb their heat is not difficult. Ordinarily ash-bin refuse will amount to from one to four tons per inhabitant per year. Of course such refuse is a poor fuel, and as it burns with difficulty would seldom be used for steam making. However, it should be burned for sanitary reasons alone and any profit resulting from the utilization of the heat is clear gain.

It is seen then that a destructor plant will combine very perfectly with a plant to supply current for sewage disinfection and for pumping.

For street lighting electricity need only be considered, as the demand for electric illumination, as against other means, is almost universal. But the peculiarity of municipal lighting as compared with ordinary commercial lighting is the constant power required while lights are in use, a feature which again lends itself happily to combination with a pumping plant and plant for sewage disinfection. Also in many cases it will be found that the amount of power required for lighting is not far different from the amount required for pumping. Now from what has been said it will be evident that in many cases a combined plant can be designed to burn and utilize the ash-bin refuse, do the pumping of water from a series of scattered wells, and supply current for street lighting and sewage disinfection, in which all the machinery will be loaded very nearly to full capacity twenty-four hours a day.

The extremely uneconomical machinery used for pumping in many places to-day, and the demand for better sanitation, offer, it seems to me, a very considerable further field for electrical machinery, and one which I trust will not long remain uncultivated.

The pressure of many recent demands must be my apology for this scant treatment of an interesting subject.

Creating an Electrical Town.

The Newark, N. J., *News* of a recent date gives the following particulars of a great enterprise:

"Besides the Weston Electrical Instrument Company, a number of other concerns in the same line of business will, it is said, in the spring locate their factories near Waverly. These others are the Weston General Company, capital \$200,000; the Weston Electric Appliance Company, capital \$750,000, and the European Weston Electric Instrument Company, which manufactures for the European market and is capitalized at \$200,000. The South Newark Land & Improvement Company, with a capital of \$50,000, is also interested.

"This project when completed will form a colony of electrical factories, and the army of workmen employed therein and housed in the immediate neighborhood will ultimately, it is thought, constitute a little town.

"Edward Weston, the electrician, is at the head of the undertaking. The Weston Electric Instrument Company, which has its headquarters at William and Shipman streets, Newark, has grown so rapidly in recent years that its present factory was found to be too restricted for its needs. A plot of ground was purchased some time ago on Frelinghuysen avenue, near Waverly, with the intention of locating new works there.

"An especial inducement was found in the fact that in that immediate neighborhood a water supply of three million gallons a day could be relied upon, a most important consideration in choosing a site for the company's power house.

"The plot has a frontage of from 1,600 to 1,800 feet on Frelinghuysen avenue, and runs west along the old road to the tracks of the Lehigh Valley Railroad. Besides that property, the company also came into

possession of a strip of land running east from the Waverly Hotel to the Pennsylvania Railroad station, besides one or two adjoining tracts. It is here that the electrical industry will construct its various works and its homes for the employees."

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XIII.—The Alkali Metals.

In Chapter I of this series (see *ELECTRICITY* August 11, 1897,) reference was made to the fact that "Electro-Chemistry" was a science dating back to the earliest years of the century. We have been so accustomed to regard this new branch of electricity as a growth of modern times that it is very surprising to find that Davy in the years 1806 and 1807 was delivering lectures before crowded audiences at the Royal Institution in London upon "Electro-Chemistry," then really a new branch of science. In the latter year Davy was fortunate enough to separate sodium and potassium in metallic form from their fused hydrates by means of the electric current, and this success raised him at once to a position of great eminence in the ranks of European scientists. The constitution of the alkaline hydrates had long been a puzzle to the chemists of that day, and when Davy on November 19, 1807, informed the audience gathered to hear him deliver the annual Bakerian lecture before the Royal Society that he had solved the problem by means of electricity, and that he had separated from these bases two metals of extraordinary properties, to which he proposed to give the names potassium and sodium, the astonishment and excitement in scientific circles was indeed great. The description by Davy of the results obtained when electrolyzing caustic potash is sufficiently interesting to be given in his own words: "A small piece of pure potash which had been exposed for a few seconds to the atmosphere, so as to give conducting power to the surface, was placed upon an insulated disk of platina. connected with the negative side of the battery of the power of 250 plates in a state of intense activity, and a platina wire communicating with the positive side was brought in contact with the upper surface of the alkali. . . . Under these circumstances a vivid action was soon observed to take place. The potash began to fuse at both its points of electrization. There was a violent effervescence at the upper surface; at the lower or negative surface there was no liberation of elastic fluid, but small globules having a high metallic lustre, being precisely similar in visible characters to quicksilver, appeared, some of which burnt with explosion and bright flame as soon as they were formed and others remained and were merely tarnished, and finally covered by a white film which formed on their surfaces."

Thorpe in his remarks upon this epoch in Davy's life says: "Sometime during the first fortnight in October, 1807, he obtained his first decisive result; and on the 19th November he delivered what is generally regarded as the most memorable of all his Bakerian lectures. Few discoveries of like magnitude have been made and perfected in so short a time, and few memoirs have been more momentous in result than that which Davy put together in a few hours, and in which he announced his results to the world. The whole work was done under conditions of great mental excitement. His cousin, Edmund Davy, who at the time acted as his assistant, relates that when he saw the minute globules of the quicksilver-like metal burst through the crust of potash and take fire his joy knew no bounds; he actually danced about the room in ecstasy, and it was some time before he was sufficiently composed to continue his experiments."*

Davy had used in fact a method of preparing these metals that to-day is being employed for their production upon an industrial scale; but it has taken nearly a century for the process to pass from the experimental to the industrial stage of its development. The cause of this long delay has been that often alluded to in these chapters on the development of the electro-chemical industries; namely, the absence of a cheap and reliable source of electrical energy in large quantities. Until the year 1892 all the potassium and sodium produced for scientific or commercial purposes were made by the chemical method of manufacture; and even the large quantities of sodium required in the aluminum process worked at Oldbury, near Birmingham, between the years 1888-1891 were obtained by the old reduction method. But the success of the electro-chemical and electro-metallurgical methods in the copper and aluminum industries had led chemists to turn their attention to the application of electricity in other branches of the chemical manufacture, and in 1893 the method used by Davy, nearly ninety years before, was put into operation upon a fairly large scale at the works of the Aluminium Company at Oldbury, Birmingham. In the years 1894-95 there were three works in England where sodium was produced by electrolysis of the hydrate or chloride, while potassium was produced by a similar process at Patricroft, near Manchester. The Aluminium Company of Oldbury are however now sole producers of sodium in England, while abroad the manufacture is carried on by the "Elektro-chemische Werke," Bitterfeld, and by the Elektro-chemische Werke, Berlin.

The following is a description of the apparatus and process as worked by the Aluminium Company, who still remain the largest producers of the alkali metals in Europe. The apparatus is protected by Patent No. 13,356, granted to Castner in 1890. An iron vessel contains the fused hydrate, which is maintained at a temperature about 20° C. above its melting point by means of gas-jets, or by means of the heat generated by the electric current. The regulation of the temperature requires considerable attention; if allowed to become too high, portion of the metal separated by the current at the cathode will become oxidized, and pass by diffusion into the electrolyte again as caustic hydrate, while if too low the fused hydrate will not remain in the fluid state, and will cease to act as an electrolyte. The cathode is of iron and projects up into the fused hydrate through the bottom of the vessel, into which it is cemented by a cooled mass of the same hydrate. The anode, which may be of carbon or of metal, is connected to the under side of the lid of the vessel, and encircles the upper part of the cathode. A small wire gauze cage is used to collect the metal which rises to the surface of the fused hydrate, and a continuation of this cage hangs as a circular curtain between anode and cathode, and acts as a diaphragm. The metal that gathers in the collecting cage is removed at short intervals (every twenty minutes) by means of a perforated ladle, and fresh caustic hydrate is added to maintain the electrolyte at a constant level. One thousand HP. is stated to be used at the Oldbury Works in operating Castner's process, and an output of one ton of sodium per day is stated to be obtained. The process is practically a continuous one. The theoretical EMF. necessary to decompose fused sodium hydrate is 4.21 volts, but the experiments made at Oldbury have shown that the decomposition can be effected with a lower EMF. than this. The discrepancy is probably due in part to the high temperature used at Oldbury. Taking the electro-chemical equivalent of sodium as .000238691 grm. and the theoretical EMF. required to decompose sodium hydrate as 4.21 volts, we find that 1,000 IHP. should produce

$$\frac{.000238691 \times 60 \times 60 \times 24 \times 1000 \times 735 \times 85}{100 \times 4.2 \times 1000 \times 1000} = 3.067$$

tons sodium per day of 24 hours. As the actual production is stated to be one ton per day, it follows

that the energy efficiency of the process as worked at

$$\frac{1000}{3067} = 32 \text{ per cent.}$$

Taking the cost of EHP. hour as .282 cent,* the cost of the power requisite to produce one ton sodium by the Castner process is found to be

$$\frac{.282 \times 1000 \times 24 \times 85}{100 \times 100} = \$57.52.$$

Since this one ton of sodium is worth at present about \$960, it is evident that the manufacture must be a profitable one. Borchers gives the following detailed estimate of the cost of 100 kgs. sodium (100 kgs. = 220.4 lbs. = $\frac{1}{10}$ metric ton) in the apparatus designed by himself for the production of the metal from the fused chloride: †

850 kgs. salt.....	\$1.68
8 tons coal for steam raising.....	7.20
1 ton coal for heating the apparatus.....	2.40
2 firemen.....	2.40
2 engineers.....	8.60
6 laborers.....	5.76
Renewing the decomposing apparatus.....	24.00
Interest and depreciation.....	8.16
	<hr/> \$55.20

The cost of the energy in this estimate is seen to be much higher than that given by the writer as the probable cost in the Castner process; but Borchers has based his calculation upon the very high current density of 467 amperes per square foot and an EMF. of 10 volts.

The market for potassium and sodium is a very limited one, and when these metals are produced by the ton it is easy for the supply to be much in excess of the demand. Much of the sodium produced at Birmingham is used by the firm themselves for the manufacture of sodium peroxide, and of cyanide for use in the cyanide gold extraction process. The latter is made by heating potassium ferro-cyanide with potassium or sodium, the product obtained by this reaction being much purer than that obtained by the usual method of cyanide manufacture.

The sales of the Aluminium Company have recently fallen off, owing to competition from Germany, but in the last report the directors state that they are taking legal proceedings for infringement of their patents against some of the competing firms.

The electrolytic method for the production of sodium and potassium described in this chapter is to be worked in America by the Electro Chemical Company of New York, who are now building works at Niagara.

Although the manufacture can never become a large one, it is one of the most interesting of the new electro-chemical industries. It illustrates well the advantages that result when electricity replaces the pyro-chemical methods of the earlier day. In this particular case, cleanliness and safety have been gained by the change.

Draw Your Dividends.

The local stockholders of the Sterling Remedy Company, makers of Cascarets and No-To-Bar, will be pleased to learn that the great "Union for Profit" has again declared its regular semi-annual dividend of 3 per cent. and the checks are now being mailed. The annual report of the Board of Directors shows that over 3,000,000 boxes of Cascarets were sold during the year 1897, and that the prospects for 1898 are indicating a doubling of the business. The great success of this great corporation was developed within two years, principally on the merit of its preparations, effective general newspaper advertising and the co-operative push of its thousands of interested and enthusiastic stockholders all over the country. It is at once an illustration of the quickness of the American people to recognize something that's good of the force of newspaper advertising, and of invincible power of co-operation.

* Estimate by present writer in *Electrician* (London), Dec. 25, 1896.

† *Zeits. f. angew. Chemie*, 1898, p. 486.

* "Humphry Davy," Thorpe, "Century Science" series, 1896.

LONDON NOTES.

[From our London Correspondent.]

Institution of Electrical Engineers—President's Address.

Mr. J. Wilson Swan, F. R. S., the new President of the Institution of Electrical Engineers, delivered his opening address on January 13th to the members of that Institution. Mr. Swan made a brief reference to the method of illumination by incandescent electric lamps which he introduced to the notice of this Institution sixteen years ago. He proceeded to make special reference to the subject of electro-chemistry and the electro-chemical industries, which, he said, were of great interest and importance, and young engineers would do well to study the field within which lay the application of electricity to chemical processes. The field was a very large one, and only a small part of it was occupied. Regarding the industrial applications of electricity, one-third of the fine copper produced in the world was obtained electrically, and the present price of aluminum, which in 1855 was nearly as dear as silver, silver itself being twice its present price, was entirely due to the development of the electrolytic method of production. He considered that the most important of all the applications of electrolysis now engaging the attention of electrical engineers was the manufacture of alkali, several electrolytical processes being now in operation for the production of caustic alkali and chlorine. Electrical methods were also in use for making sodium, chlorate of potash, carbondum, calcium carbide, and ozone, from which secondary effects of great value could be obtained. Mr. Swan touched on many other subjects, such as water power utilization and the direct conversion of heat energy into electrical, which he said was not yet within sight.

Electric Tramway Schemes.

The electric tramway schemes on foot in England are very numerous, and there are many important electric light railways waiting for the permission of the Light Railway Commissioners. An eight mile electric tramway is to be constructed from the boundary of Oldham, through Ashton-under-Lyne, Audenshaw and Denton to Hyde. These various districts have a population of somewhere about 250,000 people, and it is considered that the line has every prospect of financial success. The electrical energy for working the tramway will be supplied by the municipality of Ashton, upon certain terms per unit which have been arranged. The permanent way is now being laid, and the electrical equipment is in hand. The English investing public has just had the scheme laid before it in the form of a prospectus inviting applications for over \$400,000 in shares.

Electric Power Schemes.

Two important undertakings are projected in the way of electric power distribution. Two companies have been formed, known as the Midland Electric Corporation for Power Distribution, and the General Power Distribution Company, for the purpose of supplying electrical energy within certain areas for the convenience of manufacturers and others who are anxious to use the electric power for machinery driving, but cannot afford or do not care to put down special installations for themselves. One of the companies takes into its area a large number of very important manufacturing centers and offers very favorable terms to manufacturers in South Staffordshire. Current would be supplied at 1d. per Board of Trade unit for power, and 6d. per unit for lighting for one hour and 3d. per unit afterwards. The company would lay a comprehensive system of mains and supply motors for hire, to save outlay on the manufacturer's part. Both the schemes are meeting with considerable opposition from the municipal authorities of the districts they propose to supply. Some of them already have municipal

electric lighting plants and are afraid of competition. This is a cause of most of the opposition.

Practical Work with X-Rays.

A paper with this title was read before the newly formed Roentgen Society in London on January 11, by Mr. W. Webster, F. C. S. After describing the best forms of apparatus to use, and the various methods for avoiding failures, he stated that the best coils were of English manufacture. Reference was made to the early work of Sir William Crookes and Prof. Jackson. A tube made by Prof. Jackson in 1894 was shown, with which he had demonstrated that wood and other materials were pervious to certain rays. The speaker had found an improvement to prevent the spark from passing round the bowl of the tube and thus lessening the danger of perforation. By heating the tube and starting with a small spark he was able gradually to produce the effect he wished, and thereby had saved the lives of many tubes. The bulb of the tube should not be very large, as the larger it was the more difficult the tube was to condition and the greater were the number of accidents. An aluminum cover for the cathode tube was an advantage, and a protector of sheet iron was useful for saving the hands from the effect of the rays. Anæmic subjects were the best to photograph, while gouty subjects were particularly difficult. To produce good negatives considerable experience in photographic development was necessary, especially in the production of cloud negatives.

IMPORTANT "ELECTRICAL EXHIBITION" ARRANGEMENTS.

Aside from the fact that large amounts of space are now being taken up for the Electrical Exhibition in Madison Garden next May, and that the flow of applications is such as to exhaust every possible and available square foot, a great deal of other preliminary work is going on quietly. A very important and interesting piece of news is the acceptance by Prof. F. B. Crocker of the position of Consulting Engineer, on invitation of the management, which is desirous of associating with itself all that is best in regard to the technical side of the art. Prof. Crocker, who regards the Exhibition as a highly useful means of reaching the public, is deeply interested in its success and wishful of promoting its beneficial influence in every way. His name as Consulting Engineer is a guarantee of good work being done under his supervision by the construction staff in the disposition and safe-guarding of the exhibits. Prof. Crocker as President of the American Institute of Electrical Engineers and Professor of Electrical Engineering at Columbia University represents the highest technical skill known in the profession, and the Exhibition management felicitates itself upon the valuable acquisition.

In addition to this, an Auxiliary and Educational Committee has been formed to take general charge of Exhibition matters other than commercial, and to co-operate with the Advisory Committee which represents the New York Electrical Society. The Auxiliary Committee comprises men of the highest standing, all of whom intend to take an active part in the work and are now making extensive and interesting plans, of which news will be published from time to time. Mr. T. C. Martin, who was chairman of the very successful committee of the 1896 show, has again consented to serve in the same capacity. With him are associated Prof. F. B. Crocker of Columbia University, Prof. Morris Loch of the University of New York, Prof. W. E. Geyer of the Stevens Institute of Technology, Dr. Chas. A. Doremus of the College of the City of New York, Mr. Herbert Laws Webb of the New York Telephone Company, Mr. J. B. Taltavall, editor of the *Telegraph Age*, Dr. Park Benjamin, Secretary G. H. Guy of the New York Electrical Society, Mr. W. T. Wheeler, Vice-President and National Deputy National Association of Stationary Engineers, Lieut.

G. O. Squier, U. S. A., and Mr. Thos. A. Edison, Jr. (who is in charge of some special decorative and mechanical effects). It is believed that this committee, enjoying as it undoubtedly will the heartiest confidence and co-operation of all, will be able to accomplish some extremely useful and memorable work in behalf of the science and industry.

As already announced, the New York Electrical Society is the body under whose auspices the Exhibition is to be held, and it has appointed an Advisory Committee entrusted with its interests and composed of its present officers and past presidents, namely: Present officers—Dr. M. I. Pupin, President, and Messrs. Dunn, Sinclair, Case, Osterberg, Guy, Riker, Cobo and Ker; past Presidents—Messrs. F. W. Jones, Small, Pendleton, Crocker, Wetzler, Mailloux, J. W. Lieb, Jr., and Dr. C. E. Emery.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For *Electricity's* Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

BOOK REVIEWS.

THE MOTOR ENGINEER'S AND ELECTRICAL WORKER'S HAND-BOOK. By WILLIAM LINTERN, West Park, O. 150 p. Price, \$1.50.

This little work, which is in pocket size, was compiled, as the title indicates, with a view to furnishing a book of reference in convenient form for the use of motor engineers and street railway men. The opening pages are devoted to a general explanation of the rudiments of electricity, such as the various units used, Ohm's law, etc., and to showing how simple problems that are constantly arising in practice may be readily solved. Further directions and instructions are given as to how various electrical apparatus should be handled to obtain the best results. The little book is essentially practical in its bearing and should prove of great value to electrical workers in general. The diagrams and tables will prove especially useful.

ANDERSON'S PHYSICAL EDUCATION. By WILLIAM GILBERT ANDERSON, M. D. Published by A. D. Dana, 853 Broadway, New York. Price 25 cents, sent postpaid.

We have just received from the publisher a copy of this useful little book. It is the latest work of Dr. W. G. Anderson, the well-known Professor of Gymnastics at Yale University. The book treats of every phase of body building and is "up to date" in every particular. There are special chapters devoted to professional people, business men, women and children. It tells you how to decrease your weight if corpulent and increase it if thin. It gives valuable measurement charts for both men and women. Every reader interested in better health, greater strength, grace, self-control, elegant carriage, should possess a copy of this work.

The book is full of good suggestions for all classes. The parent who is anxious about the narrow chest of the child—the young man who is worried about his lungs and stooping shoulders—the business man on the verge of collapse—the busy editor, lawyer or minister alarmed because of an overtaxed brain and its resultant sleeplessness—the society woman, the housewife, the young lady, can all find in this book much that will benefit and help them. We know of no work that gives so many useful and helpful suggestions in such compact and readable form. The illustrations, about one hundred in number, are taken from drawings and life.

SOCIETY NEWS.

American Institute of Electrical Engineers.

The 121st meeting of the Institute, which was held at 12 West Thirty-first street, New York, on the 26th ult., was devoted to a discussion on Standardizing Generators, Motors and Transformers. The discussion was opened by Mr. E. W. Rice, Jr., and was participated in by Messrs. Lozier, Kennelly, Wolcott, Hutchinson, Lieb, Dunn, Coho, Pattison, Henshaw, Steinmetz, Mailloux, Osterberg and Mossorop. The appointment of a committee to consider the question was suggested, and subsequently the whole matter was referred to the Institute council for such action as it may deem proper.

At the meeting of the council in the afternoon the following associate members were elected:

Chas. R. Bangs, Special Agent American Telephone and Telegraph Co., New York.

M. C. Beebe, Assistant in Electrical Engineering, University of Wisconsin, Madison, Wis.

Hugh Thomas Brown, Supt. of Electrical Department Selma Gas and Electric Co., Selma, Ala.

Edward P. Buroh, Electrical Engineer Twin City Rapid Transit Co., Minneapolis, Minn.

Eben Clinch Crocker, Electrical Engineer American Ordnance Co., Bridgeport, Conn.

Albert B. Elias, Electrician Davis Coal and Coke Co., Thomas, West Va.

Alex. Stanley Garfield, Engineer Cie. Thomson, Houston, Paris, France.

Chauncey Graham Hellick, Electrical Engineer Chicago Telephone Co., Chicago, Ill.

Jacque L. Morgan, Electrical Inspector Kansas City Fire Department, Kansas City, Mo.

Herman A. Prosser, Electrician Baltimore Copper Smelting and Refining Co., Baltimore, Md.

John Joseph Swann, Assistant Editor *Engineering News*, New York.

C. Walton Swoope, Instructor in Electrical Engineering Spring Garden Institute, Philadelphia, Pa.

Jin Tachihara, General Electric Co., Schenectady, N. Y.

Henry Electrical Society.

The 96th meeting of the Henry Electrical Society will be held at Columbia University, Engineering Building, Room 302, on Friday, February 4, at 8:15 P.M., when A. H. Ford, E. E., will deliver an experimental lecture on "Transformers."

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Supreme Court of this State has decided that the appeal of the New York, New Haven & Hartford Railroad Company from the decision of Judge Wheeler of the Superior Court in the matter of the building of the Shelton Electric Railway cannot be allowed.

John E. Ridall filed a bill in equity at Pittsburg, Pa., against the Brush Electric Company, to compel the defendant company to file a bill of discovery and make an accounting to the plaintiff for goods sold in territory allotted to Ridall as agent for the company. In 1880, Ridall and Eugene Ingold, partners as Ridall & Ingold, made a contract with the Telegraph Supply Company, of Cleveland, by which they were given the exclusive agency for Western Pennsylvania and parts of Ohio and West Virginia. The agents were to receive a commission of 20 per cent. on all goods sold in this territory. The Telegraph Supply Company changed its corporate name and the partnership of Ridall & Ingold was dissolved. The interest of Ingold in the contract was assigned to Ridall February 9, 1894, and the assignment was approved by the Brush Electric Company. The plaintiff claims that beginning in 1889 the Brush Electric Company has sold and permitted to be sold through other agents goods covered by the agreement for an aggregate price of not less than \$300,000, upon which the plaintiff claims a commission of \$60,000. A suit has been entered to recover this amount, and the bill in equity is to compel the defendant company to produce certain records necessary in the trial of the case.

An attachment from Steuben County, N. Y., against the Bernstein Electric Company of Boston for \$1,459 in favor of the Corning Glass Works is in the hands of the sheriff. Dispatches from Boston, however, state that the Bernstein Electric Company has made an assignment. It was incorporated in 1888 with a capital stock of \$100,000, and the plant was mortgaged in 1889 for \$100,000. The company manufactured electric lamps and appliances.

At Ottawa, Ill., Ex-Mayor L. W. Hess has been appointed receiver of the Ottawa Electric Street Car Company, of which W. F. Ellis of Boston is president. The company was organized last year with a capital stock of \$100,000. Extensions and a resort were built at large expense, which Eastern capitalists who hold stock agreed to but have failed to pay for. The line will be operated by Receiver Hess under order of the court.

Judge Bishop at Des Moines, Ia., has rendered a decision in the case Windsor vs. the city, the Board of Public Works, the McCaskey-Holcomb Company et al. He granted the injunction asked for to restrain

the city from building the plant under the contract made last August between the city and the McCaskey-Holcomb Company. The Judge decided that the election held last May, to get the views of the voters on the city plant proposition, was rendered invalid by the fact that the two proposals submitted to the voters were contradictory.

GENERAL NEWS.

What Is Going On in the Electrical World.

Albany, N. Y.—Assemblyman Guider has introduced a bill providing that all telegraph, telephone and electric light poles and wires in cities of 50,000 inhabitants shall be removed within one year. Poles now in use in connection with underground systems are not affected by this act.

Anderson, Ind.—Articles of incorporation have been filed by W. M. Leeds, D. G. Reed, L. H. Landon and others, whose purpose is the construction of an electric railway from Elwood to Anderson and subsequently to Lapel. As Congressman C. L. Henry and Philip Matter have already secured right of way for an electric road between the two cities, the incorporation of the new company is supposed to be a move in the interest of the Panhandle Railway Company, whose line the Henry road parallels. The Henry company, however, announces that it will go ahead with the construction of its road.

Athens, Ga.—The cotton mills in this section of Georgia are rapidly adopting electricity for motive power. Two cotton mills in Clarke county have just finished putting in a full electrical equipment.

Boston, Mass.—It is understood that Tucker, Anthony & Co. of this city will finance a new electric road to be known as the Providence & Taunton Street Railway, to operate between the two cities, connecting with the Union Railway Company of Providence and the Brockton, Bridgewater & Taunton Street Railway Company at Taunton. The proposed capitalization is \$175,000 stock and \$175,000 bonds. Construction will commence in the spring. The road will be 14 miles in length and will make a direct road between Providence and Taunton. The distance between the cities by steam road is 24 miles and the fare is 60 cents, while the new company proposes to run cars between the two cities in one hour and 15 minutes and charge 25 cents.

Brooklyn, N. Y.—The laying of the trolley car tracks on the Bridge has been completed, including the loops at the New York end, and cars of two or three companies are making regular trips over the Bridge daily. The trip is made in 6 minutes.—President Rossiter of the Heights Railroad Company has sent to Sheriff Creamer a check for \$10,105.04 to settle the judgment obtained by Charles J. Patterson in favor of Robert H. Furman, who was injured by one of the company's cars in 1895.

Chicago.—The city council has passed an ordinance granting the Wisconsin, Inland Lakes & Chicago Railway Company the right to lay tracks for a period of fifty years, along, under and upon certain streets of the city. The company is given two years in which to lay its tracks and have its lines in operation and agrees to pay the city \$550,000 for the privilege. The company is capitalized for \$10,000,000 and is said to contemplate an underground roadbed for portions of its line. A. E. Case is the Chicago representative of the company.

Cincinnati.—The Walnut Hills cable line is being changed into an electric system, and by the middle of the month the hum of the trolley will have totally displaced the dull buzz of the cable.—The Norwood council having refused to grant the concession asked for by the Bullock Electric Company for the removal of their manufacturing plant to that village, it is now doubtful whether the company will establish its works at Norwood. One of the proprietors states that the company has received flattering offers from Covington, Ky., Chester, Penn., two or three places in New Jersey and several places in New York, but prefers to remain in Cincinnati or near by if possible. The Manufacturing Club of Cincinnati has taken up the matter and will try to secure a site for the company in this city.

Corsicana, Tex.—The city council has granted a franchise to M. M. Bright and E. L. Tyndale of Chicago to construct and operate an electric street car line over all the streets of Corsicana for a period of twenty-five years. The line will be operated with the Patton motor.

Cullman, Ala.—The city council has granted a franchise to J. E. Clark of this city and Charles Temple of Grand Rapids, Mich., for waterworks and electric lights. Fifteen years is the term of the franchise.

Delaware, O.—Hon. J. D. Van Deman has been removed as receiver of the Delaware Electric Railway on application of Miss Ava Main, one of the stockholders, who objected to him as being favorable to the bondholders. Captain John A. Cone has been appointed receiver in his place.

Dickson, Tenn.—Capt. John Adams, who is erecting a cob-pipe factory here, proposes to add an electric light plant to the factory and supply light for the town.

Goshen, Mass.—Interest in the proposed electric railway from Williamsburg to Goshen and Cummington was revived among the people here by the recent visit of John C. Hammond of Northampton, who is a most enthusiastic promoter of the scheme. It is now believed that sufficient stock will be subscribed to warrant the

construction of the road early in the spring. The road will be equipped for freight as well as passengers.

Grass Lake, Mich.—The question of putting in an electric lighting plant here will be voted on at the spring election.

Hagerstown, Md.—The Washington County Electric Power Company has been organized by Messrs. Lynch, Jennings and Herman of Harrisburg, the present owners of the Hagerstown Street Railway, and several Hagerstown capitalists. The plant will supply both power and light, and it is thought will absorb the Hagerstown electric light plant, which at present is owned by a Philadelphia syndicate.

Knoxville, Tenn.—It is authoritatively stated that a deal has been consummated between the Knoxville Street Railway Company and the Citizens' Railway Company, controlling the rival railway and light systems. The Knoxville Company, of which J. Simpson Africa of Philadelphia is trustee, will be reorganized and the issues of the two companies pooled. W. G. McAdoo of New York is president and W. W. Harrison of Philadelphia, a large owner of the Citizens' company, vice president. The two companies have had a long stage of litigation.

Lancaster, O.—The county commissioners of Licking County have granted a 25 year franchise to the Columbus & Buckeye Lake Electric Railway Company for the construction and maintenance of a single track electric railroad from Hebron to Newark along the east or canal side of the Newark and Hebron road.

Lexington, Va.—John R. Williams of Richmond and A. Royall of Manchester, Va., are organizing a company and have petitioned the Legislature for a charter for a street railway in this city. The line will be about three miles long.

Lima, N. Y.—There is at present a scheme on foot in this place by means of which the town may, in the near future, be lighted by electricity and the defunct Lima & Honeoye Falls Railroad converted into a trolley road. There are certain Eastern capitalists interested in it, and if they receive anything like moderate encouragement they will erect a power house midway between this place and Honeoye Falls and light Honeoye Falls as well as Lima.

Lonaconing, Md.—John M. Burchinal of Moundville, W. Va., and A. Flick of Altoona, Pa., have engaged an agent to secure for them right of way for an electric railway to be built from Cumberland to Piedmont and Westernport, via Mount Savage, Frostburg, Lonaconing and others town in the Maryland coal region.

Lykens, Pa.—An ordinance granting the Lykens & Williams Valley Electric Railway Company permission to construct its railway over Market street in the borough, and to operate by electricity according to the single trolley system, has been passed by the council.

Lynchburg, Va.—The franchise and plant of the Lynchburg Electric Company will be offered for sale on the 8th of February by the commissioners appointed by the court. The franchise of the company continues in force for thirty years from the 1st of January, 1881. The length of its railway in operation is between five and six miles. The sale is subject to ratification by the court, and will be made to the highest and best bidder, who will be required by the commissioners, before making any adjudication to him, to pay in cash the sum of \$5,000 on the day of sale, and if the sale is confirmed by the court, the balance of the purchase money must be paid within twenty days from that day.

Neola, Ia.—An election is to be held February 14 to decide whether a municipal electric light plant shall be established.

Newark, N. J.—Bernard M. Shanley, recently elected general manager of the Newark & South Orange Railway Company, has been making full inspection of the plant with a view to remedying defects and improving the line.

New York.—The Ninth Avenue line of the Metropolitan Street Railway Company, an underground electric system, has been completed and is now in operation. Early in March all the lines operated by the company north of Fifty ninth street are expected to be run by electricity or cable. The Metropolitan Company has given out contracts for 300 open cars for summer service, and 300 closed cars are now being built for the company by the Stephenson Car Company and a Philadelphia Company.

Ottawa, Ill.—The Ottawa Street Railway Company has been placed in the hands of a receiver, L. W. Hess. The cars will continue to run under the orders of the court.

Paris, Tex.—Judge D. H. Scott has been making inquiries at Fort Worth in regard to the cost and operation of electric roads, with the view, it is said, of building one in Paris.

Pittsfield, Mass.—The annual meeting of the Stanley Electric Manufacturing Company was held on the 25th ult. These officers were elected: President, W. W. Gamwell; treasurer, G. W. Bailey; manager, Henry Hine. The old board of directors was re-elected. A 6 per cent. annual dividend was declared, payable April 1. The company did \$600,000 worth of business the past year, with a gross profit of \$100,000, and has orders on hand for \$175,000 worth of machines.

Portland, Me.—The Maxham Electric Third Rail Company has been organized here for the purpose of dealing in patent rights and manufacturing all appliances of which this company may become possessed, with \$100,000 capital stock, of which \$50 is paid in. The officers are: President, G. S. Merrill of Lawrence; treasurer, E. L. Pillsbury of Boston.

Reading, Pa.—Work on the Boyertown & Reading Electric Railway is to begin immediately. The line will be about twenty miles in length and pass through a number of villages.

Richmond, Va.—A bill has been offered in the Senate by Mr. Wickham to incorporate the American Development Company, with Tazewell Ellett, Warren P. Taylor, O. F. Bresee, Jr., H. G. Buchanan, Charles V. Carrington, Wirt E. Taylor, Clyde W. Saunders, A. L. Ellett, Jr., and C. H. Fleming, all of Richmond, as incorporators. The act authorizes the company to purchase, own, sell, rent, buy, lease, etc., any real, personal, or mixed property in South America, and more especially to buy, lease, sell, rent, operate and generally to own and develop any concession, grant or franchise for street railways, bonded warehouses, cattle-packing, cold storing and shipping, railroads, telegraph and telephone lines, and to establish, operate, own, perpetuate and generally to work or cause to be worked or operated mines, mills, factories, electric plants, etc., in the republic of Venezuela. In the State of Virginia and in Venezuela the company shall have power to do a general banking business. The capital stock is to be not less than \$1,000,000, and may be increased to \$25,000,000. It is said the incorporators have ample financial backing.

Schoolcraft, Mich.—At the election held on the 25th ult., this village voted in favor of establishing water-works and electric light plant.

Silver City, Idaho.—A movement is on foot to establish an electric light plant in this place. John Tardiff, an electrician and engineer, is working the matter up.

Somerville, N. J.—The war that has been waged by the Brunswick Traction Company against the Philadelphia Traction Company for the right of way through the towns of Somerville and Raritan has resulted in a victory for the New York & Philadelphia Traction Company, which has been granted a franchise by the Somerville town commissioners to build its road through the town.

Stanton, Mich.—An electric railway from Grand Rapids to Belding, Stanton, Crystal, Ithaca and Saginaw is being strongly urged.

Sycamore, O.—The citizens have voted to bond the town in \$20,000 to build an electric light and water-works plant.

Tipton, O.—A company has been organized for the purpose of constructing five miles of electric railway to connect with Atlanta on the southern edge of the county.

Topeka, Kan.—The Brush electric light plant of Topeka has been sold under foreclosure proceedings to the Edison Electric Light & Power Company for \$5,500. This places the Edison people in complete control of the commercial electric lighting business in Topeka.

Trenton, Mo.—The Trenton Gas & Electric Light Company has been reorganized and the following officers chosen: President, Henry Wettstein; vice-president, B. C. Nichols; treasurer, R. M. Cook; secretary, T. F. Fulkerson.

Trenton, N. J.—Assemblyman Carroll has introduced in the House a bill which provides that all insulators for electric light and trolley wires shall be red in color to give better protection to employees.

Ventura, Cal.—The Ventura Land & Power Company's incandescent light and ice plants were burned on the 20th ult., enailing a total loss. The plants were fully insured.

Vincennes, Ind.—Petitions are being signed by property owners along the line, granting the right-of-way for an electric railway from East St. Louis, Ill., to this city. The Wabash & Mississippi Construction Company has the matter in hand, and will begin work as soon as the right-of-way has been secured.

Waterbury, Conn.—The Waterbury Electrical Association has been organized with the following as its officers: President, W. T. Oviatt; vice-president, J. E. Kilbourne; secretary-treasurer, George M. Chapman; recording secretary, M. Greaney.

Weston, O.—This town voted at the recent election on the question of getting an electric light plant, the result being—175 votes for, 54 against. There was great rejoicing when the vote was announced.

Wilmington, Del.—The Jackson & Sharpe Company is shipping a number of electric cars to South America for use on the tramways in Buenos Ayres. The cars are thirty feet long and similar in make to those used in this country during summer months.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—At the recent Annual Convention of the State Medical Society in this city interesting papers were read by Drs. Arthur L. Fisk, of New York, and Francis H. Williams, of Boston, in regard to results obtained from the X ray in the practice of medicine and surgery. Dr. William Haines, Jr., of Albany, gave an interesting illustrated talk about "The X-Ray—Clinical Experiences." Three X-ray machines were in operation, and their usefulness was explained by Dr. Samuel Lloyd, of New York. During the illustrations a large sheet of canvas was hung across the west end of the Common Council Chamber upon which were thrown photographic illustrations of fractured bones and the interior of the human body.

Rensselaer, N. Y.—It is stated that the material for the new plant of the Kinderhook Light & Power Company will be delivered in Rensselaer in a few days.

Arrangements have been made for setting poles and stringing wires. This work will be completed within two weeks.—At a meeting of the committee from the board of directors of the Greenbush & Nassau Railway with the contractors for building the road it was decided that the contractors, J. M. Sullivan & Co., should be notified to settle all claims and debts incurred in the building of the road on or before the 31st of January or to forfeit the contract and give back the bonds which had been given in part payment. It is stated that other contractors are ready to proceed with the work if the present contractors will give it up.

Franklin, N. Y.—The Delaware Terminal Railroad has obtained its charter and issued bonds. This road runs an electric line from Franklin to Sidney. Grading has been in operation for two months and the work is well advanced. It is expected that the road will be completed by April or May.

PERSONAL AND MISCELLANEA.

It is positively stated that more than 2,000 patents for car fenders have been issued by the Patent Office, and it is still doubtful whether a single life has been saved by their use.

The London Institution of Electrical Engineers comprises 2,762 members, made up of one honorary member, 176 foreign members, 619 members, 1,729 associates and 237 students.

The executive committee of the Milwaukee board of fire underwriters has decided to recommend the election of Edward M. Dexter as electrical inspector for that city. The position has remained vacant since the resignation of George McLaren, who left on November 1 last for Mexico as the representative of an electrical concern. Mr. Dexter was connected for several years with the Wisconsin Telephone Company.

Edward M. West in a letter to the Buffalo "Times" gives a description of Rudolph M. Hunter of Philadelphia, who was recently granted patents that have created some stir in the electrical business and may be the cause of extensive infringement suits: "Mr. Hunter," writes Mr. West, "is a man of interesting personality; he seems to take no credit to himself for the work he has done. He cares apparently nothing whether it is accredited or not so long as it is not interrupted. His tastes are inherited from a talented parentage. At the age of thirteen he invented an electrical contrivance for propelling canal boats. Since then he has unraveled many of nature's secrets one after another and made them subservient to the needs of man. If his activity continues and his success is as striking in the future as it has been in the past he will live to achieve fame in spite of his modesty and will bring to the use of art the best that science can afford."

A dispatch from Colorado Springs, Col., dated January 25, announces the death in that city by consumption of Oliver Blackburn Shallenberger, consulting engineer of the Westinghouse Electrical & Manufacturing Company. Mr. Shallenberger was considered one of the greatest electricians in this country. He was born at Rochester, Beaver County, Pa., in 1860, educated at the U. S. Naval Academy at Annapolis, and graduated third in a cadet engineer class of thirty. He resigned from the navy in 1883 to devote his entire attention to electrical study. He joined the Westinghouse Company and had full charge. He was the inventor of many leading devices which have won fame for the Westinghouse Company. Among them is the Shallenberger meter for measuring power and light, in use all over the world. During the last year he had perfected a meter which was still more accurate. He furnished all the data and working plans for the ponderous machinery which the Westinghouse Company built for the Niagara Power Company and others, and inaugurated a gigantic electric plant in Colorado Springs to furnish power to the mining field of Cripple Creek. He was in charge of the experiment laboratory of the Westinghouse Company at Rochester, and his residence in that town is one of the finest in Western Pennsylvania. He is survived by his wife, a son and a daughter.

A Madison, Wis., paper states that until he was forty-three years old Emerson McMillin, who is said to have engineered the recent gigantic and unsavory gas deals in Boston, never thought of making money. The highest salary he had ever received up to that age was \$1,800 a year. He was born in Jackson County, Ohio, in 1844, and when he was old enough to work became a charcoal burner and was for a long time a day laborer who carried his dinner in a tin pail. When scarcely out of his teens he enlisted, and at Appomattox he was a lieutenant under Custer. After he was mustered out he took up the job of digging trenches for the Portsmouth, O., Gas Company, and in 1869 had learned so much about gas that he was drawing a salary of \$1,500 a year as superintendent of the gas works at Ironton. He patented an apparatus for the purification of gas and sold it, and then became president of the Columbus Gas Company. Since then he has attained special prominence in stockjobbing circles and is about as well known as any man born west of Buffalo. The syndicate of which he is now the head controls the gas companies in St. Louis, Detroit, Milwaukee, St. Paul, Grand Rapids, Jackson, Mich., Long Branch, Red Bank, Asbury Park, N. J., and Madison, Wis. His latest acquisition was the company at Detroit. More recently he has been fighting the Standard Oil Company for control of the gas companies in several large cities, including Boston.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

RECENT COMPANY ELECTIONS.

Bossert Electric Construction Company, Utica, N. Y.—President, William F. Bossert; vice-president, H. P. Crouse; secretary, Frank G. Scofield; directors: William F. Bossert, H. P. Crouse, Frank G. Scofield and Hon. Frank Sang.

Brazil Electric Light Company, Brazil, Ind.—President, E. W. Smith; vice-president, J. E. Sherley; secretary and treasurer, Hugh Stevenson; directors: J. C. S. Bower, W. H. Cordery, William Shaw and J. N. Halstead.

Chicago North Shore Street Railroad Company, Chicago—President, J. L. Cochran; vice-president, L. S. Owsley; secretary and treasurer, Howard Abel; directors: the officers and B. E. Sunny and George Newton.

Chicago General Railway Company, Chicago, Ill.—President, John H. Whitbeck; vice-president, C. L. Bonney; secretary and treasurer, L. C. Bonney; directors: J. J. Black, John H. Whitbeck, C. L. Bonney, Lyman M. Paine, Glenn E. Plumb, L. C. Bonney and N. D. Lawton. Mr. Plumb succeeds L. E. McGann, resigned.

Chattanooga & Lookout Mountain Railway Company, Chattanooga, Tenn.—President, J. T. Crass; vice-president, Vernon Whitehead; secretary, William Cummings; directors: J. T. Crass, William Cummings, Vernon Whitehead, W. L. Frierson and John P. Sanborn of Boston.

Charlestown Gas & Electric Company, Charlestown, Mass.—President, James F. Hunnewell; directors: James F. Hunnewell, James A. Sawtell, Charles F. Byam, John Turner, Charles R. Lawrence, Charles F. Fairbanks and Quincy A. Vinal.

Cleveland Electric Railway Company, Cleveland, O.—President, Horace E. Andrews; vice-president, James Parmelee; secretary, R. A. Harman; treasurer, John F. Whitelaw; assistant secretary and treasurer, Henry J. Davis; general manager, John J. Stanley; directors: the officers and Thomas H. Brooks, Hiram Kimball and A. J. Moxham. Tom L. Johnson having declined re-election as director, the board voted to reduce the number of directors to nine, leaving Mr. Johnson's place unfilled.

Columbus Street Railway Company, Columbus, O.—President, Emerson McMillin; first vice-president and treasurer, E. K. Stewart; second vice-president, Robert E. Sheldon; secretary and auditor, P. V. Burlington; general superintendent, W. F. Kelly; directors: Emerson McMillin, of New York; O. M. Clark, of Philadelphia; E. K. Stewart, R. E. Sheldon, P. H. Bruck, O. D. Firestone, G. W. Sinks, Theodore Rhoads and E. L. Hinman, of Columbus.

Detroit Street Railway Company, Detroit. Directors: Tom L. Johnson, J. C. Hutchins, A. B. Du Pont, W. L. Johnson, Irwin Fullerton, H. A. Everett.

Edison Electric Illuminating Company of Brooklyn, N. Y.—Directors: Frank L. Babbott, E. Le Grand Beers, Charles E. Crowell, Ethan Allen Doty, Julian D. Fairchild, C. N. Hoagland, Darwin R. James, Martin Joost, Edwin Packard, Lowell M. Palmer, George Foster Peabody, Royal C. Peabody and George H. Southard.

Electric Light & Power Company, Syracuse, N. Y.—President, William Nottingham; vice-president, Charles M. Warner; secretary, George M. Barnes; treasurer, George W. Davenport; general manager, Warner H. Girvin; directors: William Nottingham, Charles M. Warner, George M. Barnes, George W. Davenport, Arthur Perry, Alvin J. Belden and William P. Goodelle.

Greenville Electric Light & Power Company, Greenville, O.—Directors: Z. T. Dorman, A. J. Klinger, Samuel Harsh, D. L. Gaskill, L. C. Anderson, A. C. Robeson, W. A. Hopkins, C. J. Herr, J. M. Bickel.

Great Barrington Electric Light Company, Great Barrington, Mass.—President, D. Ward Northrop; vice-president and general manager, Ward Lewis; clerk, F. H. Wright; treasurer, Charles J. Barget; directors: Ward Lewis, P. A. Russell, F. H. Wright of Gt. Barrington, and H. B. Butler and Ward Northrop of Middletown, Conn.

Greenport Electric Light & Power Company, Greenport, N. Y.—Directors: Geo. F. Tuthill, Geo. H. Corwin, T. E. Burns, Dr. B. D. Skinner, Hon. H. A. Reeves, S. J. Higbie, A. M. Salmon, S. B. Horton.

Hartford Street Railway Company, Hartford, Conn.—President, E. S. Goodrich; vice-president, S. G. Dunham; treasurer, D. R. Howe; directors: James J. Goodwin, Charles L. Lincoln, Atwood Collins, Daniel R. Howe, Samuel C. Dunham, E. S. Goodrich and George E. Taintor.

Harrisburg Electric Company, Harrisburg, Pa.—President, E. Z. Wallower; general manager, Charles H. Kinter; treasurer and secretary, H. W. Stone; superintendent and electrician, W. R. Fitzpatrick; directors: John I. Beggs, W. O. Bishop, H. Cohen, Thomas Heist, E. B. Mitchell, H. B. Mitchell, Benjamin M. Nead, Harry C. Ross, H. J. Stewart, Joseph Strouse, E. Z. Wallower.

Holyoke Street Railway Company, Holyoke, Mass.—President, W. S. Loomis; clerk and treasurer, William R. Hill; directors: John Olmstead, Frederick Harris, Austin E. Smith and N. D. Winter of Springfield; W. S. Loomis, W. R. Hill, R. B. Johnson, J. G. Mackintosh and J. F. Sullivan of Holyoke.

Lebanon & Myerstown Electric Railway Company, Lebanon, Pa.—President, J. M. Shenk; directors: S. P. Light, H. H. Kreider, H. C. Harner, C. Shenk, Thomas Evans and Harry Nutting.

Lewiston & Auburn Electric Light Company, Lewiston, Me.—President, H. W. Oakes; treasurer, Daniel Briggs; directors: F. M. Jordan, S. D. Wakefield, J. F. Boothby, N. L. Jordan, L. Linn Small and F. R. Conant.

Lynchburg & Rivermont Street Railway Company, Lynchburg, Va.—President and general manager, H. P. Woodson; vice-president, John P. Pettyjohn; secretary and treasurer, James I. Bowman; directors: John P. Pettyjohn, W. C. Ivey, R. I. Owen, R. T. Watts, R. J. Snead, H. P. Woodson, Mrs. Ellen M. Wall.

Mahoning Valley Southeastern Railway Company, Youngstown, O.—President, John E. McVey; vice-president, L. W. King; treasurer and general manager, A. A. Anderson; secretary, C. Y. McVey; directors: A. A. Anderson, John E. McVey, L. W. King, H. M. Robinson and C. Y. McVey.

Mt. Tom Railroad Company, Holyoke, Mass.—President, W. S. Loomis; treasurer, W. R. Hill; directors: W. S. Loomis, Frederick H. Harris, R. B. Johnson, Dr. H. O. Hastings and G. S. Graves.

Rochester Railway Company, Rochester, N. Y.—President, Frederick Cook; vice-president and general manager, T. J. Nicholl; secretary, G. G. Morehouse; treasurer, F. P. Allen; directors: Frederick Cook, T. J. Nicholl, J. N. Beckley, E. H. Satterlee, Erickson Perkins, E. M. Utton, H. P. Brewster, J. Gerling, G. W. Archer, T. De Witt Cuyler, Horace Magee, Benjamin Graham, H. Sellers McKee.

Scranton Illuminating, Heat & Power Company, Scranton, Pa.—Directors: Franklin Howell, Theodore G. Wolf, Walter Briggs and Fred C. Hand, Scranton; Clinton W. Wiener and Henry W. Darling of New York, and Edwin D. Mullen of Philadelphia.

St. Louis Electrical Supply Company, St. Louis, Mo.—President, E. Ruebel; vice-president and treasurer, W. N. Matthews; secretary, Russell Stanhope. The officers constitute the board of directors.

Toronto Street Railway Company, Toronto, Can.—President, William McKenzie; vice-president, James Ross; manager, E. H. Keating; directors: William McKenzie, James Ross, F. L. Wanklyn, W. D. Mathews, James Gunn, O. L. Porteous and George A. Cox.

Utica Suburban Railway Company, Utica, N. Y.—President, John W. Boyle; vice-president, Charles E. Smith; secretary, John H. Grant; treasurer, Charles W. Mather; directors: John W. Boyle, C. W. Mather, Charles E. Smith, James T. Gardner, B. B. Putney, John S. Capron, John H. Grant, R. G. Young, Edward Peckham.

West Chester Street Railway Company, West Chester, Pa.—President, William M. Hayes; directors: R. T. Cornell, A. G. McCausland, M. H. Matlack, J. Carroll Hayes.

Worcester Traction Company, Worcester, Mass.—President, T. C. Barr; vice-president, O. H. Clark, Jr.; treasurer, E. J. Moore; directors: Thomas C. Barr of East Orange, N. J.; C. Howard Bullock of Philadelphia; Cassius M. Wicker of New York; A. George Bullock, Francis H. Dewey, Charles B. Bratt and Stephen Salisbury of Worcester.

Worococ Street Railway Company, Westfield, Mass.—President and general manager, J. A. Lakin; vice-president and secretary, James H. Bryan; treasurer, Charles J. Little; superintendent, W. S. Townshend; directors: L. S. Stowe of Springfield, James A. Crane, James A. Lakin, R. B. Crane, D. L. Gillett, T. J. Cooley, R. W. Parks, James H. Bryan and R. D. Gillett.

COMMERCIAL PARAGRAPHS.

The latest and best transformers. Such is the announcement the Wagner Electric Manufacturing Company of St. Louis, Mo., desires to make to the trade. The last year has developed a much keener appreciation by central station men of the vital part played by the transformer in economical central station distribution, and there has gradually appeared a demand for an increased operating efficiency in transformers. Such a tendency the Wagner Electric Manufacturing Company has constantly endeavored to stimulate. With their type D transformer, which has stood without a competitor for several years, this company has achieved an enviable success. From the first day of its entrance into the field of transformer building this corporation has constantly carried on extensive experiments with no other end in view than the development of its apparatus as rapidly as the conditions of the general trade demanded it. The type D line marked a material advance over type C; in the same manner the type G now excels the type D.

In the Crescent Telephones manufactured by the Pennsylvania Electric Company of Marietta, Pa., the pertinent points in the way of improvements lie in the magneto bell and the transmitter. The working parts of the bell are arranged in an entirely new and different manner. Instead of being permanently boxed so as to make inspection and repairs inconvenient and difficult, the entire movement of the bell, that is, all the working parts, including generator ringer, coils, automatic gravity hook and all contact points and springs connected therewith, are easily and quickly removable and just as easily replaced in position, all connections and contacts being electrically positive. The use of binding posts and hinges in connection with this bell has been abandoned and large surface contact plates, held together with machine screws, have been adopted instead. This company also manufactures the Ideal Transmitter, made in accordance with the particular features used in the true "Hunnings" type of transmitter, i.e., a horizontal diaphragm on which carbon dust lies in a loose state rendering packing an impossibility. Any persons contemplating purchasing telephone apparatus would do well to address the above company, who will be pleased to answer any question relating to their product.

We are in receipt of a catalogue recently issued by the Electric Storage Battery Company, Drexel Building, Philadelphia. This work has been thoroughly revised and brought strictly up to date, and as it is fully illustrated and contains a number of tables, should prove of great value to anyone interested in accumulators. This catalogue, which contains about forty pages of matter, devotes almost half of this number to describing various plants in which chloride accumulators have been installed and the advantages derived by the use of storage batteries. As a work of reference it should prove of great value.

We are in receipt of an attractive pamphlet gotten out by the Clyde Steamship Company, 5 Bowling Green, New York, which contains some thirty pages of exceedingly interesting reading matter. This little work, which is fully and handsomely illustrated, describes in a pleasing and entertaining manner the numerous pastimes indulged

in in Florida and other parts of the Sunny South. The Clyde Steamship Company has through its great fleet of ocean ships and perfect service, made the attractive winter resorts in Florida, Georgia and South Carolina so easy of access that the very journey is in itself a delight, long remembered by all who take it. On every Monday, Wednesday and Friday at 3 p. m. one of the steamers of this line leaves Pier 29, East River, New York, for Jacksonville, touching en route at Charleston, South Carolina, and remaining there a sufficient time to afford the tourist an opportunity of visiting the interesting sights and scenes of this historic old "city by the sea." Persons desiring information relating to a trip to Florida would do well to address the above company, who will be pleased to forward a pamphlet with their compliments.

Of all the insulating materials used in the construction of electric machinery, mica is the one which undoubtedly fulfils its mission most perfectly. This substance is, however, liable to fail through mechanical errors in its preparation or application. The Walker Company of Cleveland, O., has devised processes which make the use of mica the most practical as well as the most efficient means of insulation known to the electrical manufacturer. An excellent example of the ingenuity displayed in its use is afforded by the mica rings used to insulate the commutator from the iron spider of the armature and from the shafts of motors or generators from the smallest to the very largest sizes ever manufactured.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The French engineers sent to the United States to examine and name a truck for the Paris Electric Railway chose that manufactured by the Graham Equipment Company of Boston, Mass., as it possessed very many points of merit, being simple, strong and light, smooth-riding under all loads and entirely free from tilting or oscillation. This company also controls a Brake-Bar to prevent the tilting of car trucks, which is successfully accomplished by means of a simple mechanical principle by equalizing the forces of the power applied to brake-shoes and wheels. The Graham Equipment Company will be pleased to send a pamphlet to any prospective purchaser.

Removal Notice.

We beg to announce to our friends and patrons that on and after February 1, 1898, our office and factory will be found at No. 27 Rose street, New York City.

DE VEAU & Co.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

We are in receipt of a new catalogue recently brought out by the Brown & Sharpe Manufacturing Company of Providence, R. I. This work has been thoroughly revised and brought up to date, and now contains 437 pages, 20 more than the preceding one. There are a large number of tables which make it especially valuable as a book of reference. The principal additions this year to the machines and tools this company regularly manufactures are: automatic cutting-off machine, automatic screw machine, automatic turret forming machine, belt polishing machine, universal grinding machine, improved No. 2, 60", arbors for face milling cutters with inserted teeth, face milling cutters with inserted teeth, inside micrometer gauge, micrometer calipers No. 9 and 11, micrometer depth gauge, screw slotting cutters ground for clearance, slide caliper rule, spiral gears, tools for use in screw machines, lists added to twist drill and steel wire gauge No. 776. The catalogues referred to will be mailed, upon application, to any address without charge.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

INCORPORATIONS.

The Standard Cold Electric Company, Alexandria, Va. Capital stock, \$100,000.

The Consolidated Electric Company, Fort Ann, N. Y.—to furnish electricity for lighting and power in Ft. Ann. Capital stock, \$10,000. Directors: E. L. Ashley, E. J. West and Mrs. Elizabeth H. Ashley.

The La Grande Electric Company, La Grande, Ore.—to establish an electric system in La Grande and Union County. Capital stock, \$100,000. Incorporators: W. B. Sargent, C. L. Fox and J. H. Hunter.

The Elkin Electric Light & Power Company, Elkin, N. C.—to erect, operate and maintain an electric light and power system. Capital stock, \$2,500. Incorporators: Alex. M. Smith, Gilvin T. Roth and Hugh G. Chatham.

The American Heat, Light & Power Company, Baltimore—to deal in lighting and apparatus. Capital stock, \$100,000. Incorporators: Arthur F. Spier, Perry B. McLaren, Nathaniel Z. Seitz, Nicholas P. Bond, Edward P. Hill.

The Arkansas Improvement Company, Colorado Springs, Col.—to own and operate telegraph or telephone lines, railroads, etc., carrying on its principal operations in Arkansas. Capital stock, \$250,000. Directors: J. M. Parker, H. K. Devereaux, K. R. Babbitt, E. J. Preston and L. A. Cole, all of Colorado Springs.

The Fitchburg & Westminster Street Railway Company, Fitchburg, Mass.—to build a line of electric railway from Fitchburg through Westminster to South Gardner. Capital stock, \$100,000. Directors: H. S. Pike, C. R. Streeter, F. L. Rolph, C. A. Simonds, T. S. Wood, C. C. Dawley and G. R. Godfrey.

The Atlanta Water Power Company, Atlanta, Ga.—to develop the water power of the Chattahoochee River between Jones' Shoals and Power's Ferry and use it in generating electricity for transmission to Atlanta and other places. It is understood that at least a million dollars will be invested in the enterprise. The incorporators of the company are: Henry B. Wilson and Emerson McMillin, New York; C. Emerson Smith, York, Pa., a member of a firm manufacturing electric machinery, and R. H. Smith, of Gainesville, who was instrumental in securing options on water power.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JANUARY 25, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

597,799. Electric Railway. Eben C. Crocker, Bridgeport, Conn., assignor of one-half to Edwin C. Howe, same place. Filed April 23, 1897.

597,848. Trolley. George A. Hall, Portland, Me. Filed Feb. 6, 1897.

597,949. Rail-Connector. James Bryan, Pittsburg, Pa. Filed June 12, 1897.

597,062. Device for Preventing Accidents on Railroads. Hermann Biermann, Breslau, Germany. Filed April 6, 1896.

597,864. Car-Fender. Henry C. Spangler, Harrisburg, Pa. Filed May 20, 1897.

597,936. Fender for Street-Cars. John F. Baker, Vincennes, Ind. Filed Nov. 23, 1897.

598,087. Safety-Fender for Street-Cars. William B. Heywood, Gualala, Cal. Filed Aug. 19, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

597,964. Light Refracting and Magnifying Envelop for Incandescent Lamps. Forest W. Dunlap and John R. Quain, London, England, assignors to William Castner Chapin, San Francisco, Cal. Filed June 2, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

597,816. Armature-Winding Machine. Carl Eichemeyer, Yonkers, N. Y. Filed Oct. 30, 1897.

597,855. System of Electrical Distribution. Harvey Linton, Altoona, Pa., assignor of seven sixteenths to Thos. H. Bowman, McKeesport, Pa. Filed May 7, 1894.

597,979. Electric Switch. Jesse L. Hinds, Syracuse, N. Y., assignor of one half to Huntington B. Crouse, same place. Filed Feb. 1, 1896.

597,985. Electric Meter. Gisbert Kapp, Berlin, Germany, assignor to Henry C. Townsend, trustee, New York City. Filed Nov. 19, 1897.

598,001. Electric Switch. James R. Newell, Titusville, Pa. Filed Sept. 15, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

597,782. Telephonic Installation. George Ritter, Stuttgart, Germany. Filed June 11, 1896.

597,785. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 16, 1895.

597,786. Telephone-Circuit. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 18, 1896.

597,787. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 18, 1896.

MISCELLANEOUS.

597,753. Apparatus for Making Observations by Means of Roentgen or X-Rays. Jacques Wertheimer, Paris, France. Filed July 27, 1897.

597,790. Electric Cable. Willoughby S. Smith and William P. Granville, London, England. Filed Nov. 1, 1897.

597,916. Manufacture of Storage-Battery Grids. William W. Griscom, Haverford, Pa.; Dora Ingham Hale Griscom executor of said William Griscom, deceased. Filed Nov. 22, 1895.

597,880. Electric Furnace. William S. Horry, Sault Ste. Marie, Mich. Filed April 16, 1897.

597,891. Electrically-Actuated Lock for Bicycle-Racks. Frank V. Walstrom and John Erickson, Chicago, Ill. Filed Nov. 9, 1896.

597,945. Electric Furnace. Charles S. Bradley, Avon, N. Y. Filed Dec. 12, 1894.

597,969. Safety-Fuse. Louis A. Ferguson, Evanston, Ill. Filed May 24, 1897.

598,032. Electric-Signaling Device. Eugene A. Stout, Jr., Philadelphia, Pa. Filed March 23, 1897.

598,044. Electric Burglar-Alarm System. Clyde Coleman, Chicago, Ill., assignor of two-thirds to Albert L. Dean and James W. Donnell, same place. Filed Dec. 14, 1896.

TELEPHONE AND TELEGRAPH.

A letter from Richmond in the N. Y. *Herald* of the 24th ult. gives a history of the telephone contest that has been going on in the Virginia capital for two years past and incidentally refers to the successful establishment in that city of an independent telephone system by the Richmond Telephone Company. The writer states that the telephone in use by the company has proven entirely satisfactory. "It is," he says, "the long-distance instrument of the Western Telephone Construction Company of Chicago, and the construction of the company's lines is admirable, consisting of a complete metallic circuit to each subscriber. The company is now giving service to 1,500 subscribers, and is continually extending its lines and increasing its list. The Southern Bell Company, apparently realizing that the opposition was rapidly driving it from the field, has reduced its charges to \$18 and \$30 respectively for residence and business telephones anywhere within the city limits, but in no case making permanent contracts, and where it finds that those rates are not sufficiently attractive it endeavors by giving entirely free service to keep up its list. It has now about 1,200 subscribers."

A report from Mr. Eugene Germain, late U. S. Consul at Zurich, to the State Department at Washington, regarding the telephone in France, is to the effect that there are at present 112 towns, with a population of 6,000,000, which have 18,191 subscribers, half of whom are in Paris. It is not, however, in Paris that there are the most subscribers in proportion to inhabitants, for at Cannes the proportion is 1 to 120; 1 in 198 at Fourmies; 1 in 215 in Mentone; and 1 in 222 at Tourcoing, as against 1 in 253 in Paris. The telephone is little used in comparison with neighboring countries, like Germany and Switzerland, for while the number of "communications" in France last year was only 74,000,000, the total number for Germany, excluding Bavaria and Wurtemberg, was over 424,000,000. Switzerland with a population barely the tenth of France, had, at the end of last year, over 1,000 miles of telephone lines, with 29,533 subscribers and about 15,000,000 communications. While the cost of telephoning in Switzerland is more than covered by the receipts, the contrary is the case in France, though the subscription price is much higher than in any of the other countries, being as much as \$40 per annum in Paris, and from \$40 to \$60 in provincial towns, to say nothing of each subscriber having to contribute toward getting connected with the system.

The Atlanta *Journal* states that the Standard Telephone Company has a large force of hands at work laying down the conduits for its wires within the fire limits of that city. George F. Payne & Co., Philadelphia contractors, are in charge of the work and will put on a large force of hands and push the work to completion as rapidly as possible. It is the intention of the company to have 1,000 telephones in operation by April 1 and to put in 4,000 telephones during the present year. The company also promises to have 4,000 long-distance telephones in operation in Atlanta, all of the latest patents and modern improvements, and Col. Joe James and Col. Baer are pushing the work as rapidly as possible.

The Southern New England Telephone Company, Boston, reports gross earnings in 1897 of \$595,831; expense and interest, \$480,656; dividends, \$150,660; surplus, \$14,515. At the end of the year there were 9,276 instruments in use, a gain of 1,349 over the previous year. During the year \$200,000 was charged to construction account, the company issuing that amount of additional capital. All but seven towns out of the 168 in Connecticut are now reached by the company's lines. The annual number of messages sent amount to about 13,000,000. At the annual meeting President Hudson of the American Bell Telephone Company was elected a director to succeed A. O. Morgan.

In the General Assembly of South Carolina a bill has passed its third reading which places express, telegraph and telephone companies under the control of the Railroad Commissioners, who shall have full power to regulate the prices to be charged by any company or person or persons owning, controlling or operating any line or lines of express, telegraph and telephone for any service performed. The bill also provides that the companies mentioned shall bear their pro rata share of the salaries of the Railroad Commissioners based on their gross earnings in the State.

The new telephone company of Wellsburg, W. Va., has completed its line connecting it with the Phoenix Company of Steubenville, O. This company operates exchanges at Toronto, Steubenville, Richmond, Wintersville in Ohio, and Holiday's Cove and New Cumberland in W. Va. The companies will connect with the Home Company of Pittsburg.

Articles of association of the New Telephone Company were filed in the office of the Secretary of State at Indianapolis on the 24th ult. This is an independent company which expects to compete with the Central Union Telephone Company, now monopolizing the telephone

business of Indianapolis. The New Telephone Company also intends to operate throughout Indiana.

The People's Telephone Company of Biloxi, Miss., at its annual meeting on the 20th ult. elected the following officers: President, John Walker; vice-president, J. F. McCormick; manager, E. L. Doyle; secretary and treasurer, John Carraway; assistant manager, Warren Suter. The company was organized last May, has been a success from the beginning and is now prosperous.

The common council at Ypsilanti, Mich., has ordered the Bell company to remove its telephones from the city buildings; the instruments of the New State Telephone Company will be installed in their stead. The New State Company has gained a complete victory over the Bell in Ypsilanti. It has in use there 168 instruments while the Bell company has only about one-third that number.

A Northville, Mich., dispatch states that the New State and Northville Telephone Companies will unite their forces and endeavor to do up the local Bell company. The New State has 11 telephones in use and the Northville Company 40, while the Bell has but 8. Prices have been reduced.

The Macon, Mo., telephone system has been purchased by a syndicate of local capitalists with Hon. Theo. Gary at the head, and will at once begin the extension of the lines. The consideration was \$10,000, for which amount the new company will be capitalized.

J. C. Hubinger has finally succeeded in getting permission to erect poles and string wires through Fort Madison, Ia., to connect his Burlington and Keokuk exchanges. Mr. Hubinger will execute a bond for \$2,000 guaranteeing the removal of the poles and wires providing he is not voted a franchise by the people.

At a meeting of the Citizens' Telephone Company of Columbia, Tenn., held since that noticed in the last issue of *ELECTRICITY*, additional subscriptions were secured, and there is now \$4,450 available to pay off the indebtedness. About \$1,000 or \$1,500 is needed for contemplated improvements, and this amount will be obtained without difficulty.

The Southern Minnesota Telephone Company, incorporated recently with a capital stock of \$30,000, will establish a system of telephone lines throughout Murray, Cottonwood and Pipestone counties, and, if desirable, extend the line to other parts of Southern Minnesota.

A new telephone company is being organized in Charlotte, N. C., and will use a metallic circuit system. It is proposed to connect Charlotte with the adjoining towns, and bring Columbia into the circuit, establishing at the same time a rate of 15 cents for long-distance telephoning.

The Park City Telephone Company is the name of a new company that is being organized at Bowling Green, Ky., and will at once begin the construction of new lines. The new company will put the cost of 'phones down considerably and endeavor to run the East Tennessee Telephone Company out.

Mr. Maupin's bill in the Virginia Legislature, providing that instead of the tax of \$1.50 on each transmitter a special tax of 1 per cent. be levied on the gross earnings of telephone companies, has been referred to the House Committee on Finance.

The Southwestern Telephone & Telegraph Company has been granted a franchise at Beaumont, Tex., and will establish a telephone system and exchange there.

A private telephone line is being built between Chelsea, and Pleasant Lake, Mich., a distance of 20 miles. Farm houses will be connected.

The Detroit Telephone Company has decided to buy \$30,000 worth of cable and wire to extend its service.

The Montcalm County (Mich.) Telephone Company has 115 miles of wire and 200 telephones in use.

New Companies Incorporated.

The Haskell & Throckmorton Telegraph & Telephone Company, Seymour, Tex.—to construct, operate and maintain a public telegraph and telephone line and system between the towns of Seymour and Haskell. Capital stock, \$3,000. Incorporators: T. H. C. Peery, G. P. Barber and G. C. Plants.

The Lexington Telephone Company, Lexington, Va.—to manufacture apparatus, build telephone lines and establish an exchange in Lexington. Capital stock, \$5,000. President, W. S. Hopkins; secretary and treasurer, N. C. Watts.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mfg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.					Authoriz'd	Issued.				
Albany, N. Y.—Jan. 31:						Hartford Conn.—Jan. 31:					
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q., Aug. '97.	133 1/2	Hartford Street Ry. Co.	100	\$2,000,000	\$200,000	3 % S., July, '97.	189
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Sept. 10, '97.	69	Hartford & West Hartford RR.	100	1,000,000	247,000		..
Traction Co. (Saratoga)	100	50,000	50,000		..						
Allentown, Pa.—Jan. 31:						Holyoke Mass.—Jan. 31:					
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000		..	Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., July, '97.	200
Bridgeport, Conn.—Jan. 31:						Hoboken, N. J.—Jan. 31:					
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70
Baltimore, Md.—Jan. 31:						Indianapolis, Ind.—Jan. 31:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	59	Citizens' Passenger Ry.	....	5,000,000	5,000,000		21
Baltimore Traction Co.	25	10,000,000	5,750,000	1 1/2 % Q., Jan., '97.	23 1/2	Lancaster, Pa.—Jan. 31:					
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A., 1897.	80	Pennsylvania Traction Co.	100	10,000,000	9,900,000		..
City & Suburban Ry. Co.	50	4,000,000	4,000,000	2 % A., Jan., '97.	48	Lancaster & Col. Electric Ry.	....		87,500		..
Boston, Mass.—Jan. 31:						Louisville, Ky.—Jan. 31:					
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	10	Louisville Ry.	100	4,000,000	4,000,000	1 1/2 % A., '97.	40
North Shore Traction Co.	100	4,000,000	4,000,000	3 % S., Oct., '96.	20	Louisville Ry.	100	2,000,000	2,000,000	2 1/2 % S., Apl. 1, '97.	94
North Shore Traction Co.	100	2,000,000	2,000,000	6 % S., A. & O.	75	Minneapolis, Minn.—Jan. 31:					
West End Street Ry. Co.	50	10,000,000	9,085,000	1 % S., Oct., '97.	84	Twin City Rapid Transit	100	17,000,000	15,010,000		15
West End Street Ry. Co.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	103	Twin City Rapid Transit	....	8,000,000	1,187,200	1 1/2 % A., '97.	20
Brooklyn, N. Y.—Jan. 31:						Montreal, Canada.—Jan. 31:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,000,000	2 1/2 % Aug. 1, 1897.	180	Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	247 1/2
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000		40 1/2	Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	98 1/2
Brooklyn Heights Railroad	....	200,000	200,000		..	Memphis, Tenn.—Jan. 31:					
Brooklyn City RR.	100	12,000,000	12,000,000	2 1/2 % Q., July, '97.	203	Citizens' Street Railway Co.	100	1,500,000	1,500,000		15
Brooklyn Queens Co. & Sub. RR.	....	2,000,000	2,000,000		..	New Haven, Conn.—Jan. 31:					
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1 1/2 % July 1, '97.	2	Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '96.	57
Kings County Elevated	....	4,750,000	4,750,000		..	New Haven Street Railway Co.	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	48	New Haven & Centerville	100	700,000	800,000		80
Nassau Electric Railroad	....	6,000,000	6,000,000		..	Winchester Avenue RR.	25	1,000,000	600,000		40
Atlantic Avenue Railroad	50	2,000,000	2,000,000		74	New Orleans, La.—Jan. 24:					
Brooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000		..	Canal & Claiborne RR. Co.	40	240,000	240,000	2 1/2 % S., July, '96.	140
Buffalo, N. Y.—Jan. 31:						New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Apl., '97.	123
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000		56	New Orleans Traction Co.	100	5,000,000	5,000,000		2
Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q., Sept., '97.	80	New Orleans Traction Co.	100	2,500,000	2,500,000	6 % S., J. & J.	15
Columbus, O.—Jan. 31:						Crescent City RR.	100	2,000,000	2,000,000	3 % S., July, '97.	62
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '97.	42	New Or. City & Lake RR.	100	2,000,000	2,000,000	4 % S., July, '97.	105
Columbus Central Street Railroad	100	1,500,000	1,500,000		..	Orleans Railroad	50	500,000	185,000	1 1/2 % S., June, '94.	10 1/2
Charleston, S. C.—Jan. 31:						St. Charles Street Railway	50	1,000,000	1,000,000	1 1/2 % A., '97.	55
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	New York—Jan. 31:					
Enterprise City Ry. Co.	25	1,000,000	250,000		..	Central Crostown RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	230
Chicago, Ill.—Jan. 31:						Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Apl., '97.	155
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Sept. 15, '97.	241	Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '97.	190
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800		..	Metropolitan Street Ry. Co.	100	30,000,000	30,000,000	1 1/2 % Q., July, '97.	147
Lake Street Elevated RR.	100	10,000,000	10,000,000		13 1/2	Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	4 % A., July, '97.	33
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000		4 1/2	Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 % Q., July, '97.	205
Met. West Side El. const. stk.	100	15,000,000	2,500,000		..	Cent. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 % Q., July, '97.	170
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Oct., '97.	222	Eight Avenue RR.	100	1,000,000	1,000,000		320
North Chicago City RR.	100	500,000	249,900		..	42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 1/2 % Q., Aug., '97.	325
South Chicago City Railway	100	2,000,000	1,603,200		..	Ninth Avenue RR.	100	800,000	800,000		180
West Chicago St. RR. Co.	100	20,000,000	13,189,000	1 1/2 % Q., May, '97.	100 1/2	Sixth Avenue RR.	100	2,000,000	2,000,000		195
Chicago West Div. Ry.	100	1,250,000	624,900	35 %	..	Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 1/2 % Q., Aug., '97.	320
Chicago Passenger Ry.	100	2,000,000	2,000,000	5 % S.	..	Second Avenue RR.	100	2,500,000	1,862,000	1 1/2 % Q., Jan., '97.	155
Cincinnati, Ohio.—Jan. 31:						Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Aug., '97.	179 1/2
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000		20	42d St., Manhatville & St. Nich. Av	100	2,500,000	2,500,000		75
Cincinnati Inc. Plane Ry.	50	150,000	150,000	2 1/2 % S., Feb., '98.	75	*Union (Huck)berry Ry.	100	2,000,000	2,000,000		100
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000		23	Newark, N. J.—Jan. 31:					
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1 1/2 % Q., July, '97.	115	Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000		45
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Oct., '96.	..	Newark Passenger Ry.	100	6,000,000	6,000,000		180
Cleveland, Ohio.—Jan. 31:						Rapid Transit Street Ry.	100	504,000	504,000	11 1/2 % A.	185
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000		40	Pittsburg, Pa.—Jan. 31:					
Cleveland City Ry.	100	8,000,000	7,600,000	3 % S., Oct., '97.	61	Allegheny Traction Co.	50	500,000	500,000		48 1/2
Cleveland Electric Ry.	100	12,000,000	12,000,000	3 % Q., Oct., '97.	52 1/2	Consolidated Traction Co.	50	15,000,000	15,000,000	2 % Jan., '95.	12 1/2
Detroit, Mich.—Jan. 31:						Consolidated Traction Co.	50	15,000,000	15,000,000	3 % May, '97.	44 1/2
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000		..	Central Traction Co.	50	1,500,000	1,900,000		..
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	Citizens' Traction Co.	50	8,000,000	13,000,000	6 % A.	61
Rapid Railway Co.	100	250,000	250,000		..	Duquesne Traction Co.	50	8,000,000	13,000,000		..
Detroit Electric Railway	100	1,000,000	1,000,000		..	Pittsburg Traction Co.	50	2,500,000	1,900,000	3 % Aug., '95.	23 1/2
Windsor & Detroit River Ry.	100	250,000	200,000		110	Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 1/2 % July, '97.	155
Dayton, O.—Jan. 31:						Pgh. Allegheny & Man. Trac. Co.	50	8,000,000	12,984,839	2 % Aug., '95.	185
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Oct. 1, '96.	88	Pittsburgh & West End Ry.	25	8,000,000	8,000,000	1 % Jan., '96.	19 1/2
City Railway Co.	100	600,000	600,000	1 1/2 % Q., Oct. 1, '96.	140	Pittsburg & West End Ry.	50	1,500,000	1,500,000	3 % A., June 30, '96.	..
People's Street Railway	100	1,100,000	..		90	Second Avenue Traction Co.	50	4,000,000	14,000,000		..
						Suburban Rapid Transit Co.	50	800,000	200,000	A.	..

*Unlisted. †Ex div.

b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Walbrook, Gwynn Oak & Powhatan Railway and Park.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$90 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$200,000 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 18 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,000 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

*Unlisted. † Full paid. ‡ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; e % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for \$145,000 per annum.

l Leased to Metropolitan Street Railway for 18 percent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.

p Leased to Consolidated Traction Company for 8 % per annum on par value

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.						Authoriz'd	Issued.			
New Bedford Mass.—Jan. 31:							Boston, Mass.—Jan. 31:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	23,650,000	4 1/2% Q., Oct., '97	267	267 1/2
Northampton, Mass.—Jan. 31:							Erie Telegraph & Telephone Co.....	100	...	...	1% Q., Aug., '97.	71	71 1/2
Northampton Street Ry.....	100	800,000	225,000	5% A., July, '97.	165	170	New England Telephone Co.....	...	10,894,600	10,804,600	\$1.25 sh., Q.	130	...
Omaha, Neb.—Jan. 24:							New York.—Jan. 31:						
Omaha Street Ry.....	100	5,000,000	5,000,000	...	25	...	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2% Q.	90	92
Paterson, N. J.—Jan. 31:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1 1/2% Q.	104	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	...	83	85	*Commercial Cable Co.....	100	10,000,000	10,000,000	1 1/2% Q.	180	185
Providence, R. I.—Jan. 31:							Franklin Tel. Co.....	100	1,000,000	...	2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	...	60	65	Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 1/2% Q., Aug., '97.	71	71 1/2
Philadelphia.—Jan. 31:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	...	1 1/2% Q.	107 1/2	110
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	2,000,000	...	14 1/2	...	*International Ocean Tel. Co. guar. 6%	100	8,000,000	...	1 1/2% Q.	107	110
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2% Q., July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	...	1 1/2% Q.	107	110
Hestonville, Man. & Fairmount.....	50	583,900	583,900	3% S., July 15, '97.	62	65	*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1 1/2% Q., July, '97.	150	152
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '97.	60	...	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	...	2% S.	70	76
Union Traction Co.....	50	30,000,000	5,986,095	...	15 1/2	...	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	99	101
Electric Traction Co.....	50	...	8,297,920	...	71 1/2	...	*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2 1/2% S.	85	96
dCitizens' Passenger Ry.....	50	500,000	...	...	289	290	*Commercial Union Telegraph Co.	25	500,000	500,000	8% S., July 1, '97.	117	119
dFrankford & Southwark Pass. R.	50	...	1,875,000	\$14 share A—Apr. '97	375	...	Western Union Telegraph Co.....	...	...	97,370,000	1 1/2% Q., Oct., '97.	91 1/2	91 1/2
dLehigh Avenue Ry. Co.....	50	1,000,000	...	...	40	...	Miscellaneous.—Jan. 31:						
dLombard & South Street Ry....	25	...	1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000	...	...	14	...
dSecond & Third Streets Ry....	50	1,060,000	...	...	260	...	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	174	175
dPeople's Traction Co.....	50	10,000,000	160,000	3% A., April, '97.	...	...	Chesapeake & Potomac Tel. Co....	100	...	...	...	64	65
dGermantown Passenger Ry.....	50	1,500,000	1572,800	\$5.25 share—1897.	132	...	Chicago Telephone Co.....	100	...	...	...	200	202
dGreen & Coates Passenger Ry....	50	500,000	150,000	3% July, 1897.	130	...	Central Dist. Ptg. & Tel. Co. (Pha.)	100	750,000	750,000	...	...	...
dPeople's Passenger Ry.....	25	1,500,000	1740,000	...	57 1/2	...	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1% Q.	72	78
dPeople's Passenger Ry.....	25	750,000	277,402	...	65	...	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	65	66
dPhiladelphia Traction Co.....	50	30,000,000	120,000,000	4% S—Apr. 1, '97.	81 1/2	82	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2% Q.	110	115
dCatherine & Bainbridge St.....	50	...	140,000	6% A—Mar., '97.	...	...	Providence (R. I.) Teleph. Co.....	50	...	...	...	85	...
dContinental Pass. Ry. guar.....	50	1,000,000	1540,000	\$6 share—July, '97.	...	140	Southern New Eng. Teleph. Co.....	100	8,000,000	...	...	120	122
dEmpire Passenger Ry. Co.....	50	600,000	160,000	...	...	...				
dPhiladelphia City Pass. Ry.....	50	1,000,000	1475,000	\$7.50 share July '97	176 1/2	180							
dPhiladelphia & Gray's Fy. RR....	50	1,000,000	298,650	\$3.50 share July '97	87	...							
dRidge Avenue Passenger Ry.....	50	750,000	1420,000	\$12 share, July '97	2.2	...							
dPhiladelphia & Darby Ry. guar.	50	...	1200,000	\$2 share July, '97.	...	...					
d17th & 19th Sts. Pass. Ry. guar.	50	...	1250,000	1 1/2% S., July, '97.	157 1/2	...							
dThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000	\$11 sh. A., July, '97	263	...							
dUnion Passenger Ry. Co.....	50	1,500,000	1900,000	\$9.50 share, July '97	225	226							
dWest Philadelphia Pass. Ry.....	50	750,000	1750,000	\$10 share, July '97	225	235							
Rochester, N. Y.—Jan. 31:													
Rochester Railway Co.....	100	5,000,000	5,000,000	...	16	18							
Reading, Pa.—Jan. 31:													
dReading Traction Co.....	...	1,000,000	1,000,000	Semi-an., Jan. & Jy	10	15							
dCity Passenger Ry.....	50	350,000	350,000	July, '97.	111	...							
dEast Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	60	...							
St. Louis Mo.—Jan. 31:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	...	...	...				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1888.	...	...					
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% July, '97.	124	126							
National Railway Co.....	...	2,500,000	2,479,000	1 1/2% July, '97.	...	...					
Cass Avenue & Fair Grounds.....	...	2,500,000	2,500,000	...	...	...				
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '93.	90	110							
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% July, '97.	95	105							
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% July, '97.	170	172 1/2							
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	50	52 1/2							
Southern Electric Ry.....	50	500,000	500,000	...	50	52 1/2							
Southern Electric Ry.....	100	1,000,000	1,000,000	3% S., Jan., '96.	100	102 1/2							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	...	50	51							
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '96.	...	175							
San Francisco, Cal.—Jan.													
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	108 1/2	109 1/2							
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	\$1.00 per share.	52 1/2	52 1/2							
Presidio & Ferries RR.....	100	1,000,000	550,000	...	6	8							
Scranton, Pa.—Jan. 31:													
Scranton Railway Co.....	50	6,000,000	2,500,000	...	7 1/2	10							
mScranton & Carbondale Trac. Co.	100	500,000	500,000	...	15	...							
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	...	9	11							
Springfield Ill.—Jan. 31:													
Springfield Consolidated Ry.....	100	750,000	750,000	...	...	11							
Springfield O.—Jan. 31:													
Springfield Street Ry.....	100	1,000,000	1,000,000	...	...	2							
Springfield, Mass.—Jan. 31:													
Springfield Street Ry.....	100	1,200,000	1,000,000	8% A.	205	210							
Toronto Canada.—Jan. 31:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	98 1/2	98 1/2							
Montreal Street Railway Co.....	...	4,000,000	4,000,000	4% S.	217 1/2	217 1/2							
Washington, D. C.—Jan. 31:													
Belt Ry. Co.....	50	500,000	500,000	...	...	...				
Capital Traction Co.....	100	12,000,000	12,000,000	85c. per sh. Oct. '97.	61	62							
Columbia Ry. Co.....	50	400,000	400,000	5 1/2% A.	63	68							
Eckington & Soldiers' Home Ry....	50	707,000	652,000	...	...	...				
Georgetown & Tenallytown Ry....	50	200,000	200,000	...	...	...				
Metropolitan RR.....	50	1,000,000	437,180	2 1/2% Q.	119 1/2	121							
Worcester, Mass.—Jan. 31:													
*Worcester Traction Co.....	100	8,000,000	8,000,000	...	15	17							
*Worcester Traction Co.....	100	2,000,000	2,000,000	3% S., Sept., '97.	94	97							
Worcester & Suburban Street Ry...	100	550,000	542,500	4%, 1896.	85	...							
Wilkesbarre, Pa.—Jan. 31:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction Companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 c Practically all shares owned by Union Traction Company.
 d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 e Leased to Electric Traction Company.
 f Controlled by Frankford & Southwark Passenger Railway.
 g Leased to People's Passenger Railway at \$5 per share.
 h Majority of stock owned by People's Traction Company.
 i Leased to Union Traction Company.
 j Lease transferred to Union Traction Company.
 k Leased to United Traction Co. at a rental of \$10,000 per an. in 1866-7-8, \$20,000 p. a. in 1895-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
 l Dividend of 10% guaranteed by Reading Traction Company.
 m Dividend of 6% guaranteed by Reading Traction Company.
 n Leased and operated by the Scranton Railway Company, formerly Scranton Traction Co.

ALLIED INDUSTRIES.

Boston Mass.—Jan. 31:												
American Electric Heating Co.....	50	10,000,000	.....	.....	.....	.....	..05	..07
Street Ry. & Ill'g Properties... pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	.....	.....	..	..
United Electric Securities Co... pfd.	100	.....	.....	3 3/4 % Feb., '96.	.....	.....	80	85
New York.—Jan. 31:												
Consolidated Electric Storage Co...	.....	.....	.....	.....	.....	.....	3/4	..
Edison European.....	.....	.....	.....	.....	.....	.....	1	8
Safety Car Heating & Lighting Co...	.....	.....	.....	.....	.....	.....	87 1/2	92 1/2
Worthington Pump Co..... com.	100	.....	.....	.....	.....	.....	15	20
Worthington Pump Co..... pfd	100	5,500,000	5,500,000	.....	.....	.....	83	85	
Worthington Pump Co..... pfd	100	2,000,000	2,000,000	7 %	.....	.....	.....	.....
Philadelphia, Pa.—Jan. 31:												
Acetylene L. H. & P. Co..... \$35 pd.	50	1,000,000	.....	.....	.....	.....	5	..
Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	.....	.....	.....	..
United Gas Improvement Co. scrip.	50	10,000,000	.....	.....	.....	.....	74 1/2	..
Welsbach Commercial Co..... scrip.	100	8,500,000	.....	.....	.....	.....	14	16
Welsbach Commercial Co..... com.	100	8,500,000	.....	.....	.....	.....	69	60
Welsbach Commercial Co..... pfd.	100	500,000	.....	2 1/2 % Q.	.....	.....	38	39	
Welsbach Light Co.....	5	525,100	.....	.....	.....	.....	..	2
Welsbach Light Co., Canada.....	5	500,000	.....	.....	.....	.....	.....	.....
Pittsburg, Pa.—Jan. 31:												
Carborundum Mfg. Co.....	100	200,000	200,000	.....	.....	.....	101	102	
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	.....	.....	.....	.....
Miscellaneous.—Jan. 31:												
*Barney & Smith Car Co..... com.	100	.....	1,000,000	.....	.....	.....	16	18
*Barney & Smith Car Co..... pfd.	100	.....	2,500,000	2 %	.....	.....	60	63	
Billing's & Spencer Co.....	25	.....	.....	.....	.....	.....	88	41
Consol. Car Heating Co.....	100	1,250,000	1,250,000	3% S, pas. Feb div.	.....	.....	29	31		
Johns-Pratt Co.....	100	.....	.....	.....	.....	.....	90	105
*Pratt & Whitney Co..... com.	100	.....	.....	.....	.....	.....	10	14
*Pratt & Whitney Co..... pfd	100	.....	.....	.....	.....	.....	62	68
Stillwell-Bierce Co..... com.	..	.....	.....	.....	.....	.....	96	98
Stillwell-Bierce Co..... pfd.	..	.....	.....	.....	.....	.....	107	109
Shulte Belting Co.....	100	500,000	.....	2 % Sept. 1, '97.	.....	.....	60	80	
St. Charles Car Co.....	..	.....	.....	.....	.....	.....	85	90
* Unlisted.												

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Jan. 31, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co. 1st 5s	.....	.....	.....	.....	*105¾	106½
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Jan. 31, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	106	107
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	116	.....
Central Pass. Ry. Co. 1st mtg. 5s.	96,000	117,000	1912	J. & J.	112	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	112	.....
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119½	121
\$151,000 in escrow to retire 1st mtg. bds.						
Boston, Mass.						
Date of Quotation—Jan. 31, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	161½	102½
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	107
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston, S. C.						
Date of Quotation—Jan. 31, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Jan. 31, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102½	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 2d mtg. g. 5s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	103	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,571,000	3,781,200	1928	J. & J.	.....	55
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	52
North Chicago St. RR. 1st mtg. 5s.	3,171,000	500,000	1906	J. & J.	104	104½
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	103½
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	102½	.....
North Chicago City Ry. Consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	102½	.....
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	101½	105
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	101	101½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	98	91
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101	101½
Redeemable at option on 60 da. notice.						
Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.						
Subject to call after Oct. 1, 1899, at \$110 and interest.						
Assumed by W. Chi. RR. Co., lessee.						
Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—Jan. 31, 1898.						
Cin. New. & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99½	100½
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126	130
Assumed by the Cin. St. Ry. Co.						
\$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—Jan. 31, 1898.						
Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,800,000	1922	J. & J.	99½	100½
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,219,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	106½	107½
East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106½	107½
St. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	90	95
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a.						
Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Jan. 31, 1898.						
Detroit Citizens' St. Ry. 1st Cons. 5s.	7,000,000	3,835,000	1905	A. & O.	.....	95
Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	98½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	97½	.....
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven, Conn.						
Date of Quotation—Jan. 31, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	102½	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	102½	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	102	.....

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—Jan. 21, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	100%	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100%	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	8,000,000	1943	J. & J.	78½	80
New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1903	J. & D.	106	109
N. Or.'s City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100½	101½
Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	350,000	1907	F. & A.	108	.....
Orleans Railroad Co. Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	91½	99
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	103½	.....
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
\$390,000 outstanding.						
New York.						
Date of Quotation—Jan. 31, 1898.						
Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Atlantic Av. (Brooklyn) 1st mtg. 5s.	759,000	759,000	1909	M. & S.	108	.....
Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	104½	106
Broadway & 7th Ave. 1st Cons. mtg. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Broadway & 7th Ave. 2d mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105½	108
Broadway Surface. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface. 2d mtg. 5s.	1,125,000	1,125,000	1924	.....	116	.....
Brooklyn City RR. Co. 1st Cons. mtg. 5s.	1,000,000	1,000,000	1905	.....	105	107
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1941	J. & J.	111	115
Brooklyn City & Newtown. 1st mtg. 5s.	1,000,000	448,000	1933	J. & J.	114	115
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	85	90
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	103½	103
Brooklyn, Q's Co. & Sub'n. 1st Cons. mtg. 5s.	4,500,000	2,750,000	1941	M. & N.	108	108
Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	80	.....
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	105	108
Cent Pk. N. & E. R. RR. 1st Cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	105	105½
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,100,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. scrip 5%.	1,000,000	1,000,000	1914	F. & A.	97	101
Eighth Av. RR. Co. Cert. Indebt. 6%	1,000,000	1,000,000	1914	F. & A.	100	.....
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	.....
42d St., Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	95	1.8
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	121	.....
Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	116½	.....
Second Avenue Ry. Gen. Cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	101	105
Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	112	115
South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
\$1,635,000 in escrow to retire gen. mtg. bonds.						
\$4,850,000 in escrow to retire maturing obligations.						
\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
In treasury, \$80,000.						
Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Jan. 31, 1898.						
Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	.....	.....
Toronto St. Ry. 1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	.....	.....
\$35,000 per m. single track authorized.						
\$600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—Jan. 31, 1898.						
Continental Pass. Ry. 1st mtg. 6s.	350,000	310,000	1909	J. & J.	.....	.....
Empire Pass. Ry. 1st mtg. 7s.	300,000	200,000	1900	J. & J.	.....	.....
Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....
Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	.....	1901	.....	.....	.....
People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....
People's Pass. Ry. Cons. mtg. 5s.	1,125,000	367,000	1912	M. & S.	.....	.....
People's Pass. Ry. Stk. trs. cert. g. 4s.	5,698,210	.....	1943	.....	99½	.....
Phila. City Passenger Ry. 1st mtg. 6s.	200,000	200,000	1910	J. & J.	.....	.....
Philadelphia Trac. Co. Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105
Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1903	A. & O.	.....	.....
Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....
Union Traction Co. Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	.....	.....
West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....
West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	216,000	1906	A. & O.	115½	.....
West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114½	115
The trust certificates were issued to pay for the shares of the Electric and People's Traction Lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Jan. 31, 1898.						
Birmingham, Knox & Allentown. 6s.	500,000	500,060	1931	M. & S.	87	90
Central Traction Co. 1st mtg. 5s.	375,000	375,000	1930	J. & J.	.....	.....
Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....
*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	109½	110
*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1913	J. & J.	.....	.....
Fed'l St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	.....	.....
Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1923	M. & N.	106½	107½
Pittsburg, Crafton & Mansfield. 5s.	250,000	250,000	1924	J. & J.	105	.....
Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	.....
Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	.....	.....
Pittsburg &						

With interest.

*With interest.

Digitized by

*With interest.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Jan. 31, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1906	M. & N.	101	103
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	104	107
Missouri RR. Co.....1st mtg. 5s.	1,000,000	700,000	1916	M. & S.	115	106
Mount City RR. Co.....1st mtg. 6s.	400,000	300,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	100	102
St. Louis & E. St. L. Electric.....1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	104
St. Louis & Sub. Ry.....Income 5s.	800,000	300,000	1909	M. & N.	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	111	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Jan., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	120
Ferris & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	107	109
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	100	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126	128
Metropolitan Ry. Co.....1st mtg.	200,000	200,000	1918	A. & O.	123	125
Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1912	J. & J.	110	112
Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	110	112
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	112
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	115	118
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	111
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Jan. 31, 1898.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....Cons. mtg. 6s.	500,000	500,000	1914	A. & O.	120	122
Eckington & Soldiers' Home Ry.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Jan. 31, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind'polis) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
Croswell St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	94	97
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	99½	101½
Crossett St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	94½	97½
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	101	103
Denver Con. Tram'y Co.....Cons. m. g. 5s.	4,000,000	922,000	1938	A. & O.	95	98
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	112	114
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	91
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	350,000	350,000	1928	M. & N.	116	118
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	116	118
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	90	92
Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	90	92
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937		89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900		85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. Ry. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Jan. 31, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	1922	Quar.	154	156
General Electric Co. gold coup. deb. 5s.	10,000,000	8,750,000			100%	100%
Pittsburg, Pa.						
Date of Quotation—Jan. 31, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	107
Allegheny City Electric Light Co. 1st mtg. 4s.	260,000	.....	1913	A. & O.	100	102
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Jan. 31, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	111	113
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,176,000	1903	.....	113	115
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 5s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	1923	F. & A.	103	105
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1909	A. & O.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Jan. 31, 1898.						
American Bell Telephone Co. 1st mtg. 7s.	.....	.....	1898	F. & A.	100%	104
Northwestern Telephone Co. 1st mtg. 7s.	.....	.....	.....	.....	108	110
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	110
Chesapeake & Potomac Telephone Co. 1st mtg. 5s.	.....	.....	1911	J. & D.	103%	105

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Jan. 31, 1898.						
American Electric Heating Co. 1st mtg. 5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. 1st mtg. 5s.	.....	.....	.....	.....	25	27
Barney & Smith Car Co. 1st mtg. 5s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 1st mtg. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 1st mtg. 5s.	75,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10½@10¾c.; Lake, 10½@11c.; cast, 10½@10¾c.

The St. Lawrence Power Company of Massena, N. Y., has filed with the Secretary of State a certificate of the payment of its entire capital stock of \$6,000,000.

McEniry's bill in the Illinois Legislature to tax the gross receipts of gas and electric lighting companies 4 per cent. was killed when brought to a vote.

The directors of the New England Telephone & Telegraph Company have declared the regular quarterly dividend of \$1.50, payable February 15. Books re-open February 16.

The new company that is to absorb the electric lighting companies in Philadelphia will be incorporated in New Jersey under the title of the Pennsylvania Manufacturing Company. It will have \$15,000,000 of stock and \$15,000,000 of bonds.

The directors of the Wheeling & Elm Grove Railway Company of Wheeling, W. Va., have voted to make an issue of \$225,000 worth of bonds to secure the funds necessary to build and equip the proposed extension of the road. The securities will be of the denomination of \$500.

The Cleveland General Electric 6 per cent. 530 gold bonds of 1,923 have been called for payment on March 1, 1898, at 102 per cent. and interest. Spencer Trask & Co., 27 Pine street, New York, offer to exchange the above called bonds for new first mortgage refunding gold 5s. of the Cleveland Electric Illuminating Company.

A mortgage for \$350,000 in favor of the St. Louis Trust Company has been filed in the St. Clair county recorder's office at Belleville by the St. Louis, Belleville & Suburban Electric Railway Company. The company, which is incorporated with a capital of \$350,000, is building an electric car line along the St. Clair turnpike from East St. Louis to Belleville.

A special meeting of the stockholders of the Syracuse & East Side Railway Company will be held in the office of the company at Syracuse, N. Y., on the 8th inst., for the purpose of voting upon a proposition to increase its capital stock from \$250,000 to \$375,000, consisting of 3,750 shares of the par value of \$100 each; also for the purpose of voting upon a proposition to classify the capital stock of such corporation into preferred and common stock.

We are indebted to Messrs. Spencer Trask & Co., bankers, 27 and 29 Pine street, New York, for a copy of their "Statistical Tables" for January, 1898, giving important information relative to securities dealt in on the New York Stock Exchange. The company issue these Tables annually for distribution among their clients.

The Detroit, Ypsilanti & Ann Arbor Electric Railway Company has filed a mortgage for \$600,000, to secure an issue of 6 per cent. 20-year bonds for a like amount. The mortgage runs to the Union Trust Company and is signed by J. D. Hawks, president, and John A. Russell, secretary.

The Flynn and Boland syndicates have succeeded in getting a controlling interest in the People's Traction Company and the Westchester & Connecticut Traction Company. The two roads together control about sixty miles of street railroad in the Harlem and Bronx districts, in the northern suburbs of New York.

To enable the Union Railway Company of New York to appeal to the United States Court of Appeals, Judge Wheeler on Friday last suspended for thirty days the injunction he granted recently to the Sprague Electric Railway & Motor Company, restraining the Union Railway Company from continuing the use on its cars of an electric motor of which Frank J. Sprague is alleged to have been the inventor. The Union Railway Company is forbidden, however, to purchase additional motors.

A New York correspondent in the Philadelphia "Press" of the 29th ult., says: "Within a week or ten days it is probable that the negotiation for the consolidation of various trolley lines in New Jersey into one system stretching from Jersey City to Philadelphia will be completed. The negotiations have been somewhat secretly carried on and it is not known how large a capitalization the single system will possess or what the exact terms of the financing and assimilation are."

On the 27th of January the stockholders of the Hestonville Company, at Philadelphia, by a vote of 47,043 shares against 420 shares, ratified the 999 year lease to the Union Traction at a rental of 6 per cent. on the preferred and 4 per cent. on the common stock. By the terms of the lease the Fairmount Park & Haddington road is assigned to the Union Traction, which assumes the dividends guaranteed on that stock. The Union Traction also assumes the bonded debt of both the Hestonville and Haddington companies.

Judge Wickes, of the Baltimore Court, has decided to sign a decree for the sale of the Columbia & Maryland Railroad, the proposed electric railway between Baltimore and Washington. The road has been in the courts under various forms of litigation for some time. William L. Marbury, as trustee under the first and second mortgages, will conduct the sale. The properties included are controlling interests in the Belt Railroad and Soldiers' Home Railway, both of Washington; the Maryland & Washington Railroad, stock and bonds of the Catonsville short line steam railroad, power-house, etc. It is said that the Baltimore Security & Trading Company has liens on the properties to the extent of over \$2,000,000. The road is completed from Washington to Laurel.

The Lehigh Valley Construction Company of South Bethlehem, Pa., who had the contract to open the great Massena power canal, has filed an assignment in the St. Lawrence County clerk's office at Canton. This company has been constructing a canal two hundred feet wide and three miles long from the St. Lawrence to the Grass River at Massena. Their contract price for this work was about \$3,000,000. The company has filed a mechanics' lien against the power company for \$53,000, claiming to have done \$78,000 worth of work during the past summer, for which it has received only \$25,000. The St. Lawrence Power Company is capitalized at \$6,000,000.

President Orr of the Rapid Transit Commission has expressed the opinion that the extensions of the Manhattan Elevated system which Mr. Gould proposed do not solve the problem of rapid transit. He thinks the only solution lies in an underground system. He says: "Even should the Manhattan plans be approved by the Commission and carried out, the urgent necessity of an underground road would still remain. As I have pointed out many times before, the existing transport companies would be benefited by the building of an underground system, because it would tend immediately to develop the city to the northward, would lead to the laying out of more residential districts, and would create a vast amount of new traffic, of which the surface and elevated companies would get a large share."

A semi-annual dividend of \$3.50 has been declared on United Electric Securities preferred stock, payable May 2, to stock of record April 20. The company has passed three semi-annual dividends. Payments have usually been made in February and August. "The change in dates," says the Boston "Herald," "is made for convenience, since the coupons on the company's bonds fall due in February, and it is easier to finance the two payments separately than together. The company is said to have earned the dividend. Three experts have examined the assets, and find a value equal to the bonds and shares, preferred and common, and \$80,000 to spare. The capital is \$1,000,000 preferred and \$500,000 common stock. The General Electric Company holds all of the common stock, which receives no dividends. The company issues \$1,000,000 collateral bonds against \$1,250,000 miscellaneous bonds supplied it by the General Electric Company, turning over the former in exchange. The United Company handles these securities, collecting interest and selling the same, and off the income and profit retires the collateral bonds at 103 and pays dividends. The United Company thus operates as a finance company to the General Electric Company."

ELECTRICITY.

Vol. XIV.

NEW YORK, FEBRUARY 9, 1898.

No. 3.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4021 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As *ELECTRICITY* reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	65-66
The Electrical Resistance of Alloys.	
Cast-Iron as an Insulator?	
Electric Semaphore Signals.	
An Electric Ice Boat.	
Under the Searchlight,	66
General Electric's Prosperity.	
The Bernstein Failure.	
The Lamp-Lit Lock.	
Couldn't Start the Road.	
Practice of Theory. By J. C. McMynn,	67
The Transformation of Energy in the Electric Arc,	68
Proposals Invited,	68
The Calculations of the Electrical Resistances of Alloys and Their Application to the Finding of Alloys of Definite Electrical Properties. By C. Liebenow,	69
Physical and Chemical Properties of Volatile Oils in Boilers. By W. H. Edgar,	70
Shielded Conductors. By W. A. Price,	71
London Notes,	73
Lectures on Electrical Engineering,	73
Canadian Notes,	73
The Electrical Exhibition—Personal Exhibit of Prof. S. H. Short,	73
Chicago Electrical Association,	73
Legal Notes,	74
Death of William Habirshaw,	74
Desirable Books,	74
General News,	74
Recent Company Elections,	75
Commercial Paragraphs,	75
Incorporations,	75
Electrical Patent Record,	76
Telephone and Telegraph,	76
Electrical Securities—Stocks, Bonds, Etc.,	77
Notes for Investors,	80

EDITORIAL NOTES.

The Electrical Resistance of Alloys.

In this week's issue we publish the first part of what appears to be a really very important paper on the electrical and mechanical properties of alloys.

If the author's deductions are found to be correct, we shall, for the first time, be placed in a position to determine *beforehand* the electrical properties of any alloy that may be made.

Many years ago Matthiessen claimed to have deduced from his work a general law which would enable him to determine *a priori* the general electrical properties of alloys, but Mr. Weston's elaborate researches, which resulted in the discovery by him of alloys having practically no temperature coefficient, and the further most remarkable discovery that certain alloys had a negative temperature coefficient, demonstrated beyond a reasonable doubt that Matthiessen was in error.

But Mr. Weston's investigations also proved that Matthiessen was also in error in assuming that german-silver had either a definite temperature coefficient or a definite specific resistance. Indeed Mr. Weston's researches showed that the specific resistance of german-silver increased as the percentage of nickel used increased, and that its temperature coefficient decreased as the resistance increased, and consequently it was not safe to adopt Matthiessen's values for this alloy.

Mr. Weston, however, made numerous and exhaustive researches along this line, extending to hundreds of alloys, and it is only from a sense of justice that we make the statement that it was he, and not Dr. Feussner as some people seem to believe, who discovered the properties of the nickel copper alloys referred to in the paper.

In connection with this matter, we advise any one interested in the subject to read each of Dr. Feussner's papers on the subject of resistance alloys and to note the point from which Dr. Feussner started, and it will be found that he commenced his researches on alloys of the exact composition and proportions described in Mr. Weston's United States patents. Indeed we think that Dr. Feussner's position in this is that of having intentionally but bunglingly sought to reap the whole credit due to Mr. Weston's prior work, and amongst most writers on the subject of resistance alloys Dr. Feussner and the German Imperial Reichsanstalt are given credit for the work actually done by Mr. Weston.

The manner in which this has been done will however be certain to result in disgrace to Dr. Feussner, as it is the most daring piece of scientific robbery that has come to our notice for some time, and we trust that Mr. Weston will deal with the subject in the near future.

Cast-Iron as an Insulator?

Mr. C. B. Martin, the electrical engineer of the Brooklyn Bridge, in answer to all that has recently been published regarding the possible corrosion of metal in that structure by the trolley currents, makes the following statement in the *Brooklyn Eagle*:

"There seems to be a disposition in this portion of the country to find fault with all our public works and thus make the general public afraid. Out West the press and people take a pride in their public buildings and bridges, and if there was anything wrong there would be more of a disposition to keep it from the public, for the very reason that lives might be endangered by a feeling of fear. It was this fear that was responsible for the terrible calamity that marked the opening of the bridge. The press had said that the bridge was not safe, and the panic was due to this feeling on the part of the people on the bridge at that time.

"So much has been written in regard to the danger of the bridge from electrolysis, that it seems unnecessary to deny it, as has already been done in the columns of the *Eagle*. The public need have no fear on this score, however, as the bridge is perfectly insulated. It is true that the steel is subject to electrolysis, but as the corrosion is caused by the return current we have provided for any damage from this source. This insulation of the bridge is accomplished by the fact that the cables or connections of the bridge are fixed in the masonry at the anchorages, which are made of cast-iron. Cast-iron, as was shown by the exhaustive report of the subway commission, which dug up pipes all over the city, is impervious to electricity."

Mr. Martin apparently jumps to the conclusion that it is the purpose and intent of the public press in the East to pick out flaws in various public works for the sole purpose of having something sensational to write about. This may be so in the case of a few sensational dailies, but we think the better class of papers have referred to the possibility of the Brooklyn Bridge being affected by electrolysis in order that proper precautions should be taken to prevent such an occurrence taking place. As we stated in a former editorial, there would seem to be very little chance of any serious damage being done, but it is by no means impossible, and so long as such is the case every precaution should be taken to prevent the return current from reaching the iron work of the span, or some method adopted for maintaining the anchorages at both ends at the same potential. Mr. Martin's last statement regarding cast-iron would seem a rather curious one. It is unquestionably true that corrosion does not take place anything like so quickly with iron as, for instance, with lead, for while an ampere of current will dissolve in a year approximately 75 pounds of the latter metal, this same current will dissolve in the same space of

time but 20 pounds of iron. Experience has shown, however, that cast-iron is by no means exempt from electrolytic action, and several photographs were exhibited at one of the meetings of the American Institute of Electrical Engineers a few years ago of cast-iron pipes taken from the ground at Milwaukee which were terribly pitted, and it was further stated that sections of this main had to be renewed owing to electrolytic corrosion three times in the course of two years.

If Mr. Martin is placing any great reliance on the insulating qualities of cast-iron as a protection to the anchorages, it might be advisable for him to speedily adopt some other method of preventing electrolytic action.

* * *

Electric Semaphore Signals.

Two different types of electric semaphore signals for railroad work have recently made their appearance. These devices, made in different parts of the country and produced at nearly the same time, have proved eminently successful. Engineers and electricians have been striving for a number of years to produce something satisfactory in this line, but it is only lately that their efforts have been rewarded.

Although it is only recently that electricity has been successfully and economically applied to semaphore signals, the electric current has played an important part in railroad signaling for some time.

Shortly after the block signal idea was thought of, an automatic signal of this nature, operated by compressed air and electricity, was invented. This was speedily adopted by the various railroads and was operated until what is known as the electric disk or banjo signal made its appearance, some few years ago. This latter proved fairly reliable and could be operated so extremely economically that it was generally adopted throughout this country.

Usage however brought out a serious defect in this class of signals, as they indicated danger by a change of color and not by a change of position as does the semaphore. Thus engineers often experienced difficulty in making out the signal at a sufficient distance ahead of their train. The fact that the disk signal could be operated by a low power primary battery has made it extremely valuable, especially for through line use, and accounts in a great measure for its having been so extensively adopted and so long retained notwithstanding the serious defect just mentioned.

The new electric semaphores are made in two different types, and differ radically from each other in appearance. One of them much resembles the old mechanically operated signal on a wooden pole, while the other is unlike anything of the kind that has yet appeared. The former is operated by a small electric motor which is located inside an iron case attached to a bracket fastened to the side of the pole. The working of the mechanism is as follows: When the section of track next ahead of this signal is clear, the current from a set of strong primary batteries is turned on and the motor operates until the signal has taken the "all clear" position. When a train reaches that section of the track the blade is released and gravity drives the motor and gearing back to the "danger" position.

The other type of electric semaphore is an extremely handsome and ingenious device. It consists of an enameled aluminum blade mounted on an iron pole. All the moving parts are carefully protected from the weather by being enclosed in the iron post, even to the batteries, which are located in the base. Wherever there is a moving part, ball or roller bearings have been introduced with a view to reducing friction to a minimum and consequently the amount of power necessary to operate the semaphore. Every precaution has been taken in its construction to make it as light and durable as possible, and as a consequence it can be operated with but few batteries.

This signal differs in its operation from the one

previously mentioned only in an electric release for the blade when the section of track it governs is occupied by a train. Then a catch held by an electro-magnet is released and the blade rises to the danger position without turning the armature of the motor.

A semaphore of the above type has been in successful operation on the Pennsylvania Railroad near Philadelphia for several months, so we are informed, on an extra busy section of track.

Another electric semaphore, to be used for signaling between naval vessels, has recently been invented by Lieut. B. A. Fiske. The semaphores to be used for the above purpose are six feet in length by six inches in width, and four in number, arranged one above the other on the masthead. When not in use they hang down against the mast and are invisible at a distance. To bring one into action an electric circuit is closed by an operator in another part of the vessel, and by means of an electro-magnet the semaphore can be made to stand either at right angles to the mast or at an angle of 45 degrees. It is claimed that the semaphore is more readily distinguished than small flags.

An electric semaphore signal which can be operated economically and well would unquestionably be very generally adopted by railroads throughout this country, as it would enable greater speed to be made and reduce the chances of accidents.

* * *

An Electric Ice Boat.

A rather interesting and novel test was recently made on Chevy Chase Lake, near Washington, of an electric ice boat. This vehicle-sledge, as it might be termed, is the invention of Mr. Chas. Steffgen, who entertains hopes of its proving of great commercial value in northern regions as a means of transportation.

The model which was tried at Washington was but 36 inches in length and fitted with a one-tenth horse-power fan motor. Notwithstanding this fact, it is said to have successfully drawn a load of 910 pounds against a strong breeze. The floor of the car is mounted on two pairs of movable runners, which allows of the machine being guided in any desired direction. On the rear of this platform the motor is located. The propelling apparatus consists of a metal wheel, much resembling a circular saw in appearance, which passes down through the floor as does the centerboard in a sailboat. By means of a set of bevel gears the speed of the motor is reduced and transmitted to a small sprocket wheel. The motion is again transferred by a link chain to a larger sprocket attached to the propelling wheel. In this way the machine may be geared to any desired speed. The teeth on the propelling wheel are pressed into the ice by the weight which they support, and it is thought that owing to this circumstance three or four feet of snow may easily be run over with a full size machine.

With 1½ amperes of current at 110 volts a weight of 910 pounds was easily hauled by this little sledge at a moderate speed.

It is proposed to equip the full size machines with a 15 horse-power motor to be operated by means of storage batteries. The propelling wheel will be ten feet in diameter and three-quarters of an inch thick, made of some non-corrosive metal.

From the results obtained with the working model the inventor confidently expects that with a full size machine he will be able to attain a high speed, probably sixty to seventy miles an hour. Over an evenly frozen surface such as a lake, with just sufficient weight to give the teeth a good hold on the ice, it is by no means improbable that a high rate of speed could be attained at times, but it is scarcely to be expected that such speed could be constantly maintained under working conditions.

It is thought that some such device as this could be used to advantage on the Yukon River in Alaska during the winter season, but it is Mr. Steffgen's intention to apply his invention more particularly to

lumbering and similar commercial pursuits in northern countries where no facilities for transportation exist.

Under the Searchlight.

Notes and Comments on Various Topics.

We called our readers' attention in our issue of November 24, 1897, under the head of "Top-Heavy Capitalization," to a report issued by the Akron Street Railway & Illuminating Company of Akron, O., and certified to by the Audit Company of New York.

In this report the franchises were estimated at \$1,500,000, which we thought stupendous considering the size of Akron.

We are not surprised that this road has gone into the hands of Hon. George W. Crouse, of Akron, and Alfred O. Beebe, of New York City, as receivers, upon application of the Manhattan Trust Company, the trustee of the bondholders. This was brought about by the railway company's failure to meet its January interest coupons. There is some talk of the company being reorganized. In addition to the \$1,000,000 worth of bonds held by the trust company, it is said the railroad is mortgaged to other corporations in the sum of \$185,000. There is also said to be unsecured liabilities to the extent of \$75,000.

This is simply another case of a company's being so heavily capitalized that it is next to impossible for it to earn dividends on its stock and bonds.

It seemed remarkable to us at the time that the Audit Company of New York, Mr. Ralph Beach, Mr. F. W. Child and Mr. L. H. Conant, should lend their names to an advertising scheme of this nature, for it must unquestionably have been done with their full consent. For a new concern such as the Audit Company this is certainly not a very good beginning.

* * *

General Electric's Prosperity.

(Succinctly dispatch in N. Y. News Bureau.)

The plant of the General Electric Company is employed day and night to keep up with its work on hand. It is stated on excellent authority that the company will enter on its new fiscal year with new contracts to the amount of \$1,000,000. It is stated that the company has cash on hand amounting to about \$2,500,000. Last week's net earnings showed an exceptionally heavy increase over the same week of the previous year.

If the above organization has so much ready cash on hand, why don't it pay the \$1,339,380 owing on preferred stock dividends? It must be exceedingly aggravating for the stockholders, who have received nothing for years, to be constantly told of the prosperity of the company.

* * *

The Bernstein Failure.

Regarding the Bernstein Electric Company, the assignee, Gen. Benjamin F. Beach, declines to make any statement respecting the liabilities and assets of the company. He apparently is not ready as yet to make any statements.

The last certificate of condition filed by the Bernstein Electric Company, on March 30, 1897, shows as follows: Capital stock, \$100,000. Paid in, \$97,300. Assets: Machinery, \$26,370.63; cash and debts receivable, \$20,459.38; manufacturers' merchandise—material and stock in process, \$52,199.97; patent rights, \$120,859.61; miscellaneous, \$502.73; total, \$220,392.32. Liabilities: Capital stock, \$97,300; first mortgage bonds, \$90,000; other indebtedness, \$22,110.02; balance profit and loss, \$9,982.30; total, \$220,392.32.

At the time the above certificate was filed Mr. E. W. Gilmore, as president and Mr. James Bradley treasurer, both from North Easton, Mass. The striking feature of the above certificate is the exceedingly high value placed upon the patent rights, namely, \$120,859.61. It would seem as though every enterprise in which Mr. Charles A. Coffin is

interested has its assets invariably swelled in this manner.

* * *

THE LAMP-LIT LOCK.

McFuddle had a constant drouth that wracked him day and night,
And led him into habits that were anything but right,
The chief of which was striking home immoderately tight.

His face was known in all the bars for twenty blocks around,
And every one who knew his ways knew where he could be found
As long as he could hold himself rectangular to the ground.

On reaching home full loaded he was often troubled sore
To localize the keyhole in the residential door,
And from side to side and end to end the panels would explore.

Sometimes for several minutes this proceeding would proceed
Before he found the orifice of which he was in need,
And then the pesky key would drop and make him wroth indeed.

To look for it was waste of time, so he preferred to swear,
Which always roused his patient wife, a-nodding in her chair,
And she would rush to let him in and help him up the stair.

But patience in the best of wives is subject to decay,
And her's, so lamentably tried, was ebbing fast away—
She was a fool to bear with him she heard the neighbors say.

Still what she dreaded most of all was his nocturnal fumbling
Around the keyhole of the door and consequential grumbling,
In sight of scores of peering eyes, her wifely feelings humbling.

So she bethought her if she could some simple way devise
To bring the keyhole quite distinct before her husband's eyes,
'Twould save her many a vigils and much unrest likewise.

One day it flashed upon her mind as sudden as a shock,
There was a small electric lamp that lighted up a lock,
And she looked up the ad. and found where it was kept in stock.

It didn't take her long to get an expert electrician,
Who promptly had the lamp installed in the desired position,
And then she told McFuddle all about the new condition.

He saw the point, was somewhat piqued, but praised his wife's design—
In fact, declared her little plan ingenious and fine,
And later sought his favorite bar and there set up the wine.

Believed of all impending care, he slung the throttle wide,
And set a pace whose giddy speed his fastest chums defied;
No rounder in the town that night his drinking record tied.

When midnight came they sent him home completely filled with "booze,"
With dinted hat and clothes awry and lager-spattered shoes,—
He looked like Schiller's hapless bark returning from her cruise.

He managed to get up the steps and spied a streak of light
Just where the keyhole used to be, if he could judge aright—
And this must be his wife's device to aid his errant sight.

It gave a prod to consciousness, and fingering for his key
He brought it forth, with sense enough to hold it cautiously,
And aimed it at the jet of light that he could plainly see.

He missed his mark, the little beam still met his puzzled gaze,
But what did more his muddled mind to startle and amaze
Was seeing duplicated lights replace the single blaze.

He tried again, but as before, he failed to reach the goal,
And now a dozen mimic lights seemed dancing round the hole—
The "booze" was getting in its work and gaining full control.

So rapidly increased the jets in number and in size
That soon a myriad gleaming orbs were imaged in his eyes—
Was he in an electric show or sailing through the skies?

Roused by his fears he flung himself against the offending door,
And jabbed at every spot of light its glittering surface bore,
And surged about and backed and filled and knocked his knuckles sore.

Then paused awhile to gain his breath, and with a savage yell

He tried the tactics of the goat and plunging forward fell
Headlong into the vestibule and threw his wife as well.

Awakened by the racket, she had hurried to his aid,
And had the door wide open when his final rush was made,
But was too slow in drawing back and so was struck, she said.

She scrambled quickly to her feet, unhurt but terrified,
And then to raise the "catapult" with all her might she tried,
But he was of the heavy weights and very drunk beside.

In her extremity she called the watchman and his friend,
The local "cop," and they could scarcely stand him up on end

Although assisted by the strength that size and muscle lend.

With much ado they bore him to his rooms just overhead,
And partially disrobing him they laid him on the bed,
Then pacified his sobbing wife who feared that he was dead.

A doctor summoned by a friend soon "diagnosed" the case;
He found some fever in the pulse, some bruises on the face,
Strong symptoms of exhaustion, but all the bones in place.

Then having heard from first to last the wife's suffused narration,
He told her to dismiss her fears, 'twas but severe prostration
Induced by potable excess and keyhole inflammation.

Th' prescriptions that he gave her brought the patient round all right,
Who in a week assured her he was feeling "out of sight,"
Then made a vow to mend his ways and stay at home at night.

The lamp was taken from the lock, and worn as a charm
Now serves to keep McFuddle out of many kinds of harm,
For every time he looks at it his conscience takes alarm.

* * *

Couldn't Start the Road.

Curious things occur in the operation of underground trolley systems. When the electric current was first turned on the downtown section of the Madison Avenue line in New York to test it, the night before the cars were to start running, the current breaker for that section popped out with a bang, denoting a short circuit somewhere along the line. As there was nothing in the vicinity to account for this, it was finally decided to follow the slot along from the power house and find the trouble. This was done, and after some hours the trouble was located at the curve where the line turns from Fourth Avenue into Astor place. There some laborer, extra careful of his shovel, which was his own property, had stowed it away for the night handle down and with the blade carefully pressed up diagonally between the two current-bearing conductors. When the men tried to remove it they found it was firmly welded to each rail and had subsequently to be cut away with chisels. It was a fortunate thing for the laborer that the current was not turned on when he stowed the shovel away so carefully.

* * *

A BILL has been introduced in the House of Representatives at Washington declaring trusts or combinations of any kind whatsoever to be illegal, and persons engaging in or maintaining the same in any way to be deemed guilty of a felony, proof of which shall subject the guilty party to a fine of not exceeding \$10,000 and imprisonment for not more than 15 years nor less than two years. The bill further declares that every person monopolizing, or even attempting to do so, any part of trade between the several States or between foreign nations, shall be guilty of a like crime, punishable in the same manner. The bill carries with it the power to invest Circuit, District and State courts with authority to try such cases. Property owned by any such combination being transported from one State to another would be forfeited to the United States, and would be seized and condemned by proceedings similar to those provided in the case of forfeiture of goods imported into the United States contrary to law. Any person injured by such corporations or combinations may bring suit in the various courts named, and he would be able to recover twice the amount of the damage sustained, the costs of the suit, also a reasonable fee for his attorney. The author of the bill is Representative Greene, and it has been referred to the Committee on the Judiciary.

THE PRACTICE OF THEORY.*

BY J. C. M'MYNN.

The subject of this short paper reminds me of a trolley car, for the reason that it can be turned either way and run equally well. Whether the subject should be the "Practice of Theory" or the "Theory of Practice" I must leave for your judgment.

In the development of electrical machinery, together with the necessary steam auxiliaries, theory and practice have been the complements of each other, and neither could have reached the present stage of perfection without the assistance of the other.

Theory is much more progressive, and as a usual thing precedes practice, for practice paves the way, lays the track, and makes it possible for the practical man to become a factor in the engineering profession.

The object of this paper is neither to praise nor decry theory or practice, but to simply recall to your minds the close relations existing between the theoretical man and the practical engineer. To a certain extent we are all theorists, for we have our own original ideas and fancies, and oftentimes the engineer who prides himself on his being a practical man is the most theoretical.

However, it is with regret that I notice that the old-fashioned engine driver is fast disappearing. How he could sneer at and deride "book learning" and "book-foolishness!" But he deserves our respect and admiration for the success he attained and the hard work which he expended happily but unnecessarily. He knew nothing of the B. T. U. in his coal, nor of the entrained moisture in his steam, nor of the hyperbolic curve in his engine, but he managed to keep his engine and plant going, and to still have time to ridicule "book learning."

We have also met the theoretical engineer or college boy who could calculate the thermal efficiency of an entire plant from the coal pile to the incandescent lamp, but who could not start a Corliss engine, and who would be worthless in an emergency.

Neither of those men fill our ideal, but a proper combination between the two will give us an able, earnest, thoughtful and cautious engineer. Engineering colleges are to-day turning out, year after year, educated engineers who are exerting a strong influence on the profession, which is resulting in a strong union of practice and theory, the outcome of which must necessarily be engineers of a high standard, with broader and deeper foundations of learning and experience.

In my idea the application of theory to practical work is of the utmost importance to every owner of steam and electrical machinery. In construction work as well as in operation it is most valuable. To be sure, an engineer can consult a text or hand book and can there find out that masonry will sustain certain loads or that a girder of given dimensions will support a certain weight, but if he is unable to understand "the how" and "the why" he is much more liable to make an error. One may read that phosphorus is detrimental to boiler and other steel, but if the reason is not clear, can one appreciate the danger arising from its presence?

To a certain extent, the manufacturer represents the practical side of engineering, while the inventor and consulting engineer represent the theoretical side, yet frequently the manufacturer sees the advantage of practising theory, and in such cases we see experimental laboratories established in large plants and original research carried on under the supervision of the most competent theorists.

I firmly believe, after mature observation, that the educated engineer who can master practice as well as theory is the one who will rise above his competitors in the future. Yet do not understand that by "educated" I mean necessarily a college graduate. A man who can master the laws of mechanics and can conquer mathematics by his own

* Paper read before the Northwestern Electrical Association, Milwaukee, Wis., January 19, 1898.

exertions is deserving of more credit than one who was sent to college and learned simply because it was pounded into him.

Nearly every modern machine is an example of the practical application of mechanics and design to theoretical ideas and discoveries, which thus become mechanical laws. Men knew that the electric current would some day become of commercial value, and long before the perfected dynamo appeared the laws governing the generation of the current were known.

A recent invention is a good example: For years we have known that a boiler feed-pump was doing much more work than was necessary, for if water were pumped into a closed tank at an elevation above the water level and then this tank were opened into the boiler, the water would run into the boiler by gravity. The invention consists of forcing the water to a level above the boiler, and then shutting valves and utilizing gravity. The saving made is about 85 per cent. of the steam formerly used by the pump. I simply mention this as a good example of the practice of theory.

In a certain way, theory is the foundation and practice the structure of an engineer's attainments. The deeper and more substantial the foundation, the higher and more imposing can be the superstructure; the more substantial the foundation, the more resistance will the structure have to either the winds of adversity or the more dangerous gusts of flattery and adulation.

THE TRANSFORMATION OF ENERGY IN THE ELECTRIC ARC.*

The mechanism of the conversion of electric energy into heat in the electric arc still evades the inquiries of experimenters, but papers are from time to time published dealing with the subject, and new suggestions made, and new conclusions reached, without any conspicuous approach to an explanation of what occurs. Mrs. Ayrton's laborious and systematic observations are in recent years the most important of these contributions. Of course "explanation" in such a case as this means no more than that the phenomena are shown to be subject to laws and conditions which are ascertained and well recognized in other cases, even though the mode of action in the latter may be quite obscure. The reference of the planetary motions, and the weight of terrestrial bodies, to one law of the attraction of gravitation, is called an explanation of these phenomena, though the mode of attraction is not less obscure than the phenomena it explains, and the very idea of action at a distance may be abandoned as a misleading fiction. Following a course of this kind, one experimenter after another has attempted to find laws for the behavior of the electric current in the arc similar to those which it obeys in a metallic conductor.

Electricity flowing through a metallic conductor generates heat at a rate proportional to the square of the current, and the independence of that coefficient, which is called the resistance, of the amount of current passing, is so conspicuous a property of metals and their alloys that it seems to indicate some marked characteristic in the mechanism of their conduction. So when a current of electricity flows through a junction of two different metals heat is developed, or absorbed, at a rate directly proportional to the current, and here again the coefficient involved, viz., the electromotive force of contact, is a physical constant not less significant than the resistance. The molecular structure of metals is unaltered by the passage of the current, and no transfer of matter takes place.

This last property clearly differentiates the mode of conduction by metallic conductors from that by the arc, where disruption and transfer of matter occur. The *prima facie* improbability is very great that conduction by the arc is regulated by laws similar to the peculiarly exact and simple ones which

apply to metallic conductors. All attempts to represent the heat developed in the arc as due to a resistance and a back EMF.—or, in other words, to express it as the sum of two terms containing the first and second powers of the current respectively—have been futile, and it appears unwise to persist in attacking the question on these or similar lines.

If the arc consists of molecules torn from the positive carbon, employed in the incessant to and fro bombardment of the poles, carrying positive charges to the negative and negative charges to the positive carbon, the mode of transference of the charges is by convection and not by conduction; and an attempt to represent the action in terms of the ideas used for metallic conduction is analogous to an attempt to enter the statistics of a town supply by water carts on printed forms arranged for the data of a pipe supply.

An observation that under certain circumstances an increase of current in the arc is accompanied by a diminished potential difference between the carbons, led the observer, drawing too closely the analogies with metallic conduction, to the absurd conclusion that the arc possesses negative resistance. No portion of the heat generated in the arc has been traced to a distinct cause involving transformation of energy proportional to the square of the current; and we have no ground for assigning resistance to the arc.

Prof. Fleming, in a letter to the *Electrician* of January 7, considers the probability of the existence of a "counter electromotive force in the arc," and makes an interesting suggestion as to its possible source. It is not quite clear what idea is expressed by the words "counter electromotive force." They must mean something more than a means whereby electrical energy is converted into heat in direct proportion to the current, and seem to imply that the action is reversible, and to some extent elastic, so as to produce an EMF. in the reverse sense, if only for a very short time, on the sudden cessation of the main current. Such an action has been looked for repeatedly in the arc, but never, we believe, detected. It occurs in every other case we can call to mind, to which the term "counter electromotive force" is applied. It is not obvious why it should be looked for in the arc at all. An elastic action implies a return from a more to a less strained condition, and if the energy in the arc is employed in the disruption and mutual bombardment of the carbons, no reversible effect is to be expected.

Prof. Fleming suggests that the current may generate heat in direct proportion to its amount when passing from a hot point to a cooler one in carbon vapor, by analogy with the Thomson effect in copper, or solid carbon; the existence of a difference of temperature in the carbon vapor being inferred from the difference of temperature in the carbon rods at the arc. The explanation requires carbon vapor and solid carbon to be in contact at two very different temperatures at the same pressure, and to have very different thermo-electric gradients; since if the gradients were the same, the total development of heat, by a Thomson effect, between the distant ends of the carbons, which are at the same temperature, would be zero. The latter condition may be satisfied: we have no knowledge of the matter; but it is hard to see how two very different temperatures can be found in a small body of vapor, presumably saturated. The existence in hot gases of an effect similar to the Thomson effect in solid conductors is only guessed at, but it offers an interesting subject for experiment. If this effect is found in carbon vapor, electromotive forces between the solid and gaseous carbon might exist at the contact surfaces, similar to the Peltier effect in metals, and the energy converted at those points might be expected, by analogy, to be considerably greater than that due to a difference in the thermo-electric gradients in the solid carbon, and in its vapor.

It may be observed here that the reduction in the potential difference of the carbons for a given cur-

rent, by heating the negative carbon, is explained by the bombardment hypothesis, as well as by Prof. Fleming's.

Observations on the distribution of potential in the arc are difficult to interpret, but it appears that the difference of potential between the central part of the arc and the negative carbon is small or zero, and that the whole fall of potential in the arc takes place at or near the positive crater. At this point disruption of matter is taking place, and the generation of heat under these conditions and the generation of heat by a Peltier or Thomson effect, where no change occurs in the condition of the matter concerned, seem phenomena, *prima facie*, to be placed in very different categories. It would seem that little assistance in this question is to be expected from analogies drawn with the phenomena of electric conduction in solids. The phenomena seems rather allied to those of discharges in rarified gases and movements in electrolytic solutions.

Electric Lighting of Powder Magazines.

Acting on the instructions of the French Minister of War, a committee of the Académie des Sciences have drawn up a report on the precautions to be taken in fixing electrical conductors in or near powder magazines. The committee make no distinction between electric light and power conductors and telephone or telegraph wires, since all these may be exposed to lightning. The recommendations can be summarized as follows: All underground conductors for electricity, as well as gas and water pipes, should be kept at least 10 yards from the magazines. Aerial lines should be placed even further away—20 yards is recommended—and should be so arranged that they will not fall across the magazine in case of fracture. If light is required inside the magazine all wires are to be led in strong metal pipes, and then all switches and fuses, etc., controlling the lamps are to be placed outside the magazine. Only fixed lamps are permissible, and then they should be protected by a second envelope of glass. No voltages over 110 may be used. Any electric bells required in the magazines must be placed at least four yards from the powder, and the bells must be such as require very little current.

Changing Alternating to Direct Current.

Leo Graetz discusses an electro-chemical method of changing alternating into direct currents, his conclusions being given as follows: "An electrolytic cell, one of the electrodes of which is composed of aluminum, causes a great decrease in the strength of any current sent through it when the aluminum electrode is the anode, and the separation of oxygen takes place on it but leaves the current unaffected when the aluminum is the cathode. If through a series of such cells an alternating current is sent, and the number of cells is so chosen that the anode-polarization balances, or is greater than the tension of the current, the positive portion of the current, for which the aluminum would act as anode, is checked and only the negative current passes. On this principle, a method of converting an alternating current into a direct current is based."

Proposals Invited.

The War Department, through the United States Engineer at New London, Conn., is inviting sealed proposals until March 3, 1898, for electric lighting and power installation at Great Gull Island, New York. Specifications and full information regarding the work will be furnished prospective bidders upon application to Major Smith S. Leach, New London, Conn.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

* From the *Electrical Review*, London.

THE CALCULATIONS OF THE ELECTRICAL RESISTANCES OF ALLOYS AND THEIR APPLICATION TO THE FINDING OF ALLOYS OF DEFINITE ELECTRICAL PROPERTIES.*

BY C. LIEBENOW.

It is not necessary to dwell here upon the importance of the properties of alloys as used in technics. The utility of alloys depends frequently upon their tensile strength, or luster, or permanency, or non-oxidation due to atmospheric causes, and frequently upon the numerical value of their electrical resistance and its independence from variations in temperature. Nevertheless their properties in general are very little known, and all our knowledge is derived only from observation in special cases. We can never be sure when compounding a new alloy whether it will differ decidedly from those investigated previously; a small increase of one of the constituents may result in a remarkable change in some of the properties. Even the measurements of the electrical resistance of supposedly identical alloys made by different observers have resulted in variations of as much as 50 per cent. or more, notwithstanding that the observers have exercised great care in the electrical and chemical determinations.

Even the question of the chemical nature of alloys has never been made clear as yet. In general we believe that alloys are either solutions of metals in each other or that they are really chemical combinations, a fact which has already been stated by Matthiessen in England forty years ago, who first investigated the electrical conductivity of alloys in a systematic manner. As to which of the alloys are real chemical compounds or simply mixtures there is considerable difference of opinion. Lately theories have been advanced upon the analyses of common liquid solutions to decide if a real metallic compound is built in the molten alloy. If however these conclusions do allow different explanations I do not wish to investigate them here. In any case we do not know if chemical compounds built in the molten state will not decompose again in the moment of solidification. If therefore we have made an alloy in the desired percentage proportion how can we decide whether we have a chemical compound or physical mixture of the constituents? If we wish to learn the chemical nature of solid alloys we must have a method of testing them in the solid condition without dissolving them.

Of all the properties which appear mostly changed in alloys from the properties of pure metals the electrical conductivity is the most striking. Feussner, for instance, found the resistance of certain nickel alloys not only to be five times as large as that of nickel and about thirty times as large as that of copper, but he also found the temperature coefficient of these alloys very materially different from those of its constituents.

The temperature coefficient of all pure metals, as is well known, is always positive and relatively high, about the same as we find the coefficient of expansion of gases. But in these alloys the temperature coefficient was partly nil and partly even negative.

Are we forced under such circumstances to assume a chemical combination of the metals with entirely new properties?

Matthiessen, who had already found similar results, did not yield to this opinion, but when asked how such large variations could result, he answered with the counter question, Are not all the other physical properties changed?

This of course means simply an extension of the question, but in placing it in parallel with the other one inspires some hope that as soon as we find the reason for one of these changes we will also acquire a better understanding of the other ones.

In order to be able to follow up the increase of

electrical resistance of alloys by calculation, it is necessary to adopt some theory about the constitution of the metals. We do not need to look about for this, but may select the well-known molecular hypothesis on which the science of modern chemistry is built up. According to this, all bodies are composed of small particles which cannot be further divided without destroying the properties of the body and which are known as molecules. The molecules again consist of still smaller particles, called atoms, which are themselves not further divisible.

I assume the same hypothesis for the solid metals, and this hypothesis is sufficient, as we will soon see with the help of some well-known empirical deductions—to permit an algebraical expression—for the increase of resistance. In case of melting two metals together the molecules remain unchanged; we have simply a physical mixture. In case, however, the metals exchange their atoms in melting them together, we would have new and other molecules than we had before melting the metals together, and we therefore would have a chemical combination of the metals; or in other words, when we call a metal a simple metal whose molecules consist of the one kind of atoms, in this case where each molecule consists of atoms of different kinds we would call the alloy a compounded metal.

We will consider first the simple alloys, which consist only of molecules of similar atoms, and we will choose as an example a gold-silver alloy. In this case we have throughout the whole alloy gold and silver molecules mixed thoroughly with each other. If we send through a wire consisting of such an alloy an electric current, and if we follow up a single thread of current within this wire, this current would pass alternately gold and silver molecules. If we consider the passage of such a current thread out of the wire, then we would obtain a thread which is composed of two metals alternately. If we were able, for example, to heat up every even contact point by a flame and could cool down every odd contact point, say by applying a very small piece of ice, there is no doubt that such a thread would generate an electric current exactly like a thermopile. This experiment cannot be performed, but we can make use of another way to accomplish the same effect. If we send an electric current through such a thread, the well-known Peltier effect will take place—i. e., the current will generate heat by going over from the one metal to the other and absorb heat in returning. Therefore the passing current increases the temperature, we will say, of all the even contact points and decreases the temperature in all the odd contact points. By this the current is generating an electromotive force, and it can be easily shown that this thermo-electric force must be always in opposite direction to the EMF, which causes the current itself to pass.

The electric current then generates in every second on the even contact points a definite quantity of heat and absorbs nearly an even quantity of heat on the odd contact points. In case our thermopile is well insulated against radiation, the temperature difference between two consecutive contact points must in the beginning continually increase. As, however, metals are conducting the heat, the heat will flow from the warm contact places to the cold ones through the metal itself. The quantity of heat going over in units of time will constantly increase as the temperature difference increases, till finally in every second just as much heat is conducted off as is generated. Then a stationary condition has been reached at which the temperature differences remain constant and a constant EMF. of the pile has been reached.

I would not like to tell you to develop mathematically the details of this theory. Whoever is interested in it will find the same in my paper, "Ueber den Elektrischen Widerstand der Metalle," which is published in the *Zeitschrift für Elektrochemie*, and which is also edited in book form.

This thermo-electric force which is generated in the pile from the moment when a stationary condition has been reached can be expressed by the following equation:

$$\pi = \frac{1}{n} \times \frac{l}{1-n} \times \frac{a_1}{a_2} \times i.$$

In this equation π designates the EMF., l the length, and q the cross section of the pile; i designates the current strength, and a_1 and a_2 are constants which depend upon the thermo-electric behavior of the molecules and their internal heat conductivity, and n and $1-n$ are the quantities of the alloyed metals expressed in parts of the total volume.

The first fraction on the right hand of this equation is therefore a constant for the particular alloy. If we designate this constant by c our equation reads

$$\pi = c \frac{l}{q} \times i.$$

You will be aware that we have here an expression of Ohm's Law— c corresponding to the specific resistance.

This equation holds good, as already stated, from the moment a stationary condition has been reached. The calculation furthermore shows that this condition will have been reached so much the quicker the shorter the single elements are; and the rate of decrease in time is greater than the corresponding decrease in length of elements. If the length of the elements are commensurable by the same units as the molecules, which means about one millionth of a millimeter, a rough calculation shows that already within a millionth of a second after the current is passing the deviation from the definite stationary condition would be so small that it is impossible to express it in per cent. If we would express it as a decimal, we would have to write down more than a thousand ciphers before the first numeral. The apparent resistance therefore is reached so quickly that there is no way of detecting any deviation in the first moment even with the most sensitive measuring instruments. And even if not, the self-induction in the pile would depress in the first moment the current impulse.

If we could, therefore, build a thermopile out of such small elements, and if the metals of which this pile consists would have no absolute resistance whatever, the pile would nevertheless show an apparent electrical resistance on account of the thermo-electric force, and this apparent resistance we would not be able to differentiate from a common electrical resistance of metals.

Our wire must certainly consist of a number of threads of such thermopiles, it seems to me therefore perfectly reasonable if I assume that there exists in the alloys besides the common resistance another apparent resistance of the form as expressed in the above equation.

I may here mention that I believe that the reason for an electrical resistance in pure metals in which no heterogeneous molecules are contained is due to a similar cause, "the Thomson phenomena."

If we now simply consider the alloys, we will be able to test our hypothesis, for example, by Matthiessen's observations.

Matthiessen divides the metals into two classes. To the first class, A, belong those metals which conduct the electrical current proportionally to their volume. To this class of metals belong lead, zinc, tin and cadmium. To the class B belong those metals which when alloyed with each other or with metals of class A will always conduct the electrical current in a lower degree than indicated by their proportions. To this class probably all other metals belong.

(To be continued.)

*Paper read before the Elektrotechnischen Verein on Nov. 28, 1897. (Translated for ELECTRICITY.)

PHYSICAL AND CHEMICAL PROPERTIES OF VOLATILE OILS IN BOILERS.*

BY W. H. EDGAR.

I have not written a paper, but will speak on the subject of the use of volatile oils, hydrocarbon, kerosene and oils of that nature, in the steam boiler. I do not believe there are many cases in this country where we get petroleum or other oils in our feed-water supply, but the general laws of nature are such that our waters are heavily impregnated with lime and magnesia, which are the main ingredients, the scale-forming salts, that form an incrustation in the steam boiler, which incrustation is a poor conductor of heat as compared with iron, so that we are forced to look around for something to counteract the evil effects of this incrustation and to get rid of it if possible; so that has led us to put most everything into our steam boilers, and among the different reagents employed have been volatile oils. I know that they have pumped turpentine and resinous oils into boilers up in the lumber districts, because they found in districts where they were sawing hemlock and oak that the sap and washings from them have apparently kept the boilers clean, so thought if they put a little of the product they were working on into their boilers it would have the same effect, it all being vegetable. These volatile oils, including turpentine and oils of that nature, are all hydrocarbons, and when they have been put into steam boilers have caused a corrosion or general eating and deleterious effects upon the boilers from their use.

In the oil fields years ago they put in what was called an oil brick, made from petroleum, and that was not successful; lately, in the last few years, they have been in the habit of pumping into the steam boilers kerosene, etc. I know of one party in Chicago who is at the head of some six or eight large plants, one of the largest corporations we have in the city of Chicago, who put naphtha gasoline into his boilers for years, and would persist in saying that it did the work to perfection, but had to stop using it, due to the leaks, etc.

There are two ways of looking at this subject of incrustation and its proper antidotal reagents. A boiler is very much like the human system; we are liable to injure it and we are liable to put something into it where the after effects are worse than the disease; so we must take up both sides of the question. Now, I want to bring out a few points about volatile oils and kerosene. Kerosene is a light distillate hydrocarbon and has been used very extensively throughout the country, or tried here and there, and dropped for one and another reason, and I will offer these suggestions and take up these points without any personal motive whatever, for I have none, but I will just simply take up the evil effects of kerosene and petroleum and their different distillates. Kerosene pumped into the steam boiler with the object of converting the incrustation into such form that we can readily wash it out, or prevent its formation, I will consider in the first place. Kerosene is a hydrocarbon. If we had a carbon hydrate, an animal oil, we would get an oleate radical and could possibly get the oleate of lime or oleate of magnesia, which however would not help us out, but we could get a chemical reaction from carbon hydrate having a combining acid radical there; but in the hydrocarbons we have no possible acid radical; we have not the base; we have not the combination that will take the place of either base or an acid radical and we get no chemical reaction whatever, and the action of the kerosene is purely mechanical, following the laws of capillary attraction. If I dip a blotter into water, the water will run up the side and penetrate the blotter; if the blotter is set over a tumbler of water, the water will penetrate through the substance of the blotter; and if you play a hose on a brick wall the moisture will penetrate to the other

side. Now, kerosene, being a light volatile oil, will penetrate everything of a porous nature such as lime, magnesia, etc., and will penetrate to a greater extent and more rapidly than water. The scale incrustation in the boiler will be softened, will be penetrated by this kerosene, due to the laws of capillary attraction; the scale being porous, the kerosene will work through to the iron, and when it comes in contact with hot metal the oil will run back of the sheet of the scale between the scale incrustation and the iron, and when you shut your boilers and draw your fires and let out your water, your boiler contracts, the iron contracting and expanding with the application of heat. Now, you have put a substance of different physical properties, of a different nature, between your lime and magnesia incrustation and your iron sheet or plate. The lime and magnesia, little particles of them, will attach themselves to the sheet, due to the general affinity that they have for hot metal; they cling very tenaciously to the iron, and when this substance comes in between, you have lessened that adhesive property and the incrustation is not adhering as tenaciously, and consequently, being a non-conductor and not expanding and contracting uniformly with the iron, it is more readily scaled off, and you get a great quantity of this broken scale from the continued use of a volatile oil such as kerosene. The kerosene does not change the chemical composition of the scale; its action is purely mechanical.

Now, there are other points to be looked at. Kerosene volatilizes in the steam boiler; you get probably a third over with your steam; it passes off immediately and begins to come over from about 150 degrees to 300 degrees Fahrenheit. (I was going to bring a little retort and a receiver up here, but thought it would be in the way and we would not be able to set it up.) This kerosene that passes over constitutes hydrocarbon distillate and your steam is hydrogen and oxygen, and you know the evil effects from condensation in a steam plant; you know that every year you have in your heating system to put in a few more nipples or an elbow here and there. When you put in a light volatile oil of a hydrocarbon nature you intensify that action and you get a series of oxidizing hydrocarbon reagents that will intensify that general pitting and grooving 10 per cent.; that is, you will get the general eating through of the joints and connections probably a hundred times as quick as you would otherwise. Besides that, the kerosene carries over into your cylinders. It is a part of the cylinder oil in the first place; they all come from the petroleum, except the animal oils. The kerosene is a solvent for them. It dilutes your cylinder oil; it has a tendency to change its lubricating properties just that much, and with the hydrogen and oxygen of the water and the compound formed in the distillate, you will get blackening of your piston rods and the deleterious general oxidizing effect on your rings, and if you have a metallic packing you will have hard work keeping your packing in your engine. From these same distillates, these same products formed in your distillation, you will have the pitting and the general eating through of all the threads of your joints and connections, through your entire steam system; not only that, but the part that is left in the steam boiler and the part that goes through your scale and reaches the iron cannot stand that high heat. It is carbonized. It is all decomposed, and in the carbonizing of the hydrocarbon oil in the presence of iron or against the iron sheet you are going to carbonize your iron, and you will have a blistered appearing spot where the iron has been carbonized; it will be of a blackish, blistered appearance, and you will get that action all through the water submerged part of your boilers. You will never get all your scale out with kerosene; you will never get more than a third, and those who are using kerosene and claim it is working fine simply look at the scale that they take out and do not look into the boiler to see what is left. In my travels I have had some of my

best friends tell me that they have used kerosene and their boilers are clean, their system is in good shape, and I have gone down to their plants and looked around, and in the steam system from the boilers to the engine I have seen the little leaks; and when this leakage does start in and the flange gives out and you have to put a new one in, in taking that apart you jar the whole system and bring to sight more leaks where your piping is half eaten through and almost ready to leak. Of course an old plant will show up leaks in a few months or a year, but a brand new plant will disclose leaks in time if you continually use kerosene.

Now, why do people want to use kerosene? It is generally the man up at the office end of the institution that clings to the practice; it is generally the superintendent or the manager that clings to kerosene, because it costs nothing; he is getting something for nothing. That is where so many men have made a mistake even in the running of large enterprises and large businesses. One of the greatest dangers is to look for something for nothing. Even in the hiring of men to represent them and in the hiring of help—in the hiring of brains around their establishment—they are not willing to pay; they want ten dollars put in their hands before they will give eight dollars. A man cannot do that in business; you cannot get something for nothing and you cannot get any man to run his business without profit. This is true of boiler compounds, which to the modern steam plant owner is far behind all other branches of science. If you will in using kerosene, or using any volatile oil of that nature whatever, take the subject up and look into it for yourselves, you will find that the deleterious effects, the general carbonizing and pitting, the general eating away of that thin natural skin of the iron (the finish as it comes from the boiler maker) is a dangerous thing. It takes several years to scale a boiler to start with, on a fairly good water, but if it is scaled once it will scale again in three months, because the skin of the iron is gone. When the skin of the iron is once gone, the scaling ingredients readily attach themselves to the rougher iron, while in the new boiler they cannot adhere as rapidly as they can in the boiler where the skin is gone.

Mr. Thayer—I would like to inquire what the chemical reactions are that occur between the pure water and the iron, and also between the mixture of pure water and the hydrocarbon oil and the iron. There has been a great deal of trouble in exhaust steam where the condensed water was absolutely pure and a strong corrosive action on the iron being found which is stronger at the pressure of 212 degrees than it is with the high pressure steam. The New York Steam District Company in their steam mains had them originally laid with return pipes, and they found that their returns were so badly corroded that they had to waste all the water of condensation instead of returning it to the boiler.

Mr. Edgar—It is purely an oxidation with the aid of hydrogen. We get the same effect there as we would get in a boiler where you are using the water over and over again and the water is too pure, or you are pumping rain water and distilled water back into your boilers and you get a pitting same as the submerged part of the boiler; you get a pitting and grooving of the iron; and in these pits which have a scab over a great many of them or the appearance of a scab, if you tap that off you will find underneath a little raw sore, you might say a hole, eating through the skin of the iron, a pit-hole, and in that hole you will find a red powder and this powder is the ferric hydrate. You get the same thing by taking tincture of chloride of iron and adding ammonia water precipitating ferric hydrate, which is $\text{Fe}(\text{OH})_3$, and by boiling the same as we would boil it in the pharmaceutical laboratory it is converted into its oxides, finally going into black magnetic oxide of iron, which is a black gritty powder having the physical properties of the black manganese dioxide, and is found in the bottom of the boiler. In

* Address before the Northwestern Electrical Association, Milwaukee, Wis., January 19-21, 1898.

FEB. 9, 1898.]

this deleterious action on the piping from the distilled water you have a water which is not satisfied. You know water is the greatest solvent known to chemistry. We have no artificial liquid or anything produced by nature that is so great a general solvent as water. It must take up something in solution to keep it satisfied. It has got to be satisfied. It is as natural for water to want to take up something in solution as it is for a woman to want a baby. It is natural for water to want to take up something and take care of it and hold it in solution. All nature is governed alike. We are all subject to magnetic attractions, electrical currents, absence of heat, chemical affinities and natural laws, and we find the same thing in chemistry—each element has its given affinity and its natural influence over nature.

Mr. Thayer—The water acts on the iron and produces ferric hydrate with the liberation of half the hydrogen, is that it?

Mr. Edgar—Yes, we get direct oxidation by the way of a hydrate. Also we often pump our fresh water into the heater and get pitting in the heater and not in the boiler, which is due to lack of circulation and the freeing of the air and oxygen held in the water, and it is almost a direct oxidation in that case. But we get a more rapid oxidation in the presence of the H_2O pure. It is in an unsatisfied condition, and our iron is taken up as a hydrate from that to an oxide; that is, from our analysis and personal investigations we find that we have got to satisfy the water.

If you could in some way get into the condensing system, that is, into the steam system where the condensation begins to take place, and introduce something to satisfy that water, you would stop that trouble, but I do not believe you can do that. There is no way of really reaching that.

Mr. Thayer—Hot water, then, containing the carbonate and sulphate of lime and magnesia will not exert that action except in a modified degree?

Mr. Edgar—Yes.

Mr. Ralph—What is your idea in regard to the vegetable compounds?

Mr. Edgar—Speaking of vegetable compounds, we should use sugars and tannins only, and in the following way: We find that we can take care of the carbonates of lime and magnesia with tannin extracts, and this is what we want; we do not want the extracted tannic acid.

Mr. Ralph—Well, the tannin is what these lumbermen were getting when they were getting it out of their oak and different lumbars, but when they got into the pine forest they got a resinous gum as I understand it?

Mr. Edgar—Yes, sir. We want the tannin in the extract form and still combined and containing the inert matter—the sap, the sugar and the starch. We want that because we do not want the straight, pure tannic acid. It is too stable in itself to be readily convertible into tannates. Our object is to convert carbonates of lime and magnesia into tannates. Now we find that we cannot work on gypsum, the sulphate of lime, with tannin. We find that gypsum is one of the four insoluble sulphates and that it is so stable in itself that it is not even soluble in its own acid, and is soluble only in the analytical laboratory in small quantities in hydrochloric acid.

Mr. Thayer—Have you worked on the magnesium sulphates too?

Mr. Edgar—Yes. Now we find that sugar introduced into the steam boiler with the water will convert the sulphates into saccharates. The saccharates break up into oxalates, tartrates and carbonates, and in the presence of tannin extracts part of that goes into tannate of lime, so that we need but a small proportion of sugar present in the general mixture to handle a water containing both the sulphates and the carbonates. Your sulphates and carbonates are to be proportioned according to the percentage of the carbonate and sulphate contained in the water, determined by analysis.

Mr. Ralph—You spoke about introducing the compound into the steam boiler or condenser. Do you not think that would be a good way to neutralize the effect of the water, if possible, before it went into the boiler?

Mr. Edgar—Yes, indeed. Take it back as far as you can take it through the system. The tannins in the extracted form and blended with the sugar give you no tannic acid reaction or action on the metals. You have got your readily converted tannins and they will take up lime and magnesia only, and under the conditions it is impossible to get any effect on the iron or metal. It also has no effect whatever on the gaskets or any of the substances of an organic nature in your packing. Using a vegetable mixture of that kind you will keep your gaskets pliable. You will keep all your connections and your boiler plant intact, with never a leak, and you can keep your boilers absolutely clean, and you can go to the wholesale druggist and buy the materials yourself; and it is well always to mix in a little slippery elm and poke root or powdered willow hardwood pulp so as to get a little soluble wood starch to keep your sugars from being too stable and the tannins likewise, so as to get readily convertible tannates and saccharates. We should not have a thing too well satisfied—we cannot change it, the actions are not there—we are in the realm of organic chemistry where the combinations are very complex. We get a reaction a great many times in chemistry which is not true to our general text books; that is to say, there is many a chemist who has determined something in his laboratory and completed a reaction, and he has formed a company to exploit his new method of making white lead, for instance, at one-quarter the price at which it has been hitherto produced. He goes right on with his work; he is perfectly sincere and confident. A big factory is put up, machinery is started and everything is set going, but the results do not come. The chemist then changes everything and perhaps puts in some electrodes with a little current for the purpose of excitation, but all fails, and many a fortune has been lost on such laboratory results. On the other hand, there are a hundred and one things that take place in our manufacturing establishments on a large scale, produced by nature, that we cannot reproduce in the analytical laboratory.

Mr. Norcross—You do not recommend, as I understand it, the use of kerosene oil to remove scale in boilers?

Mr. Edgar—No, sir; under no circumstances should kerosene oil be put in the boiler. I would make the same remark in regard to caustic soda.

Mr. Norcross—Your suggestion in regard to the skin on the iron is important.

Mr. Edgar—I would advise you to get a tube that is all scaled over and seal it up at the bottom of an iron kettle and play your flame up in the middle of it, then put your kerosene and water in there and watch the action.

In answer regarding steam heaters: I think one of these steam heaters is a good thing on hard water, for you get from 50 to 70 per cent. out. If a water is so soft that you get all the impurities out it becomes too pure and you pit your boilers. Water is a great solvent. In the East, where the soil is principally granitic, there is very little scale, only about two or three grains to the gallon; but throughout the West, where there is a limestone soil, you get from 16 to 40 grains.

A surface blow-off contrivance is very good, but the trouble is they are expected to do all the work, and sufficient interest and care is not usually taken in the application of such contrivances. The boiler is too often neglected and it cannot get up and speak its piece like the engine when anything is wrong.

You must diagnose your case and work out your own ideas.

Do not forget to treat the boiler regularly. Put in regularly whatever you use. Have the water analyzed and go to the wholesale druggist and he can

mix up the tannins and sugars in proper proportions; but do not use any soda. Some sulphate waters require considerable starch, slippery elm, etc.; they sometimes use 5 or 6 per cent. of carbonate soda in boiling together, which kills the gelatinous properties, and then when you introduce your tannin extract the carbonate is converted into tannate of soda—5 per cent. tannate of soda, 20 per cent. of sugar and 50 per cent. of tannins.

The steam users in the country should look into this thing and should study their boilers. There is an article on the impropriety of the use of caustic soda in the October issue of the *National Engineer*, also one on "Water" in the December issue. The greatest point in regard to compounds is the care given to the boiler. We should get the engineer interested in the matter.

SHIELDED CONDUCTORS.*

BY W. A. PRICE.

Mr. Mordey's paper on "Dynamos," read on May 20th, before the Institution of Electrical Engineers, has produced a long series of articles and letters in different periodicals, proposing and solving a number of paradoxes and puzzles of more than usual interest. Some of these are curious and excellent examples of magnetic problems that can be dealt with sufficiently by the application of first principles though complete solutions would be difficult mathematical exercises. The first puzzle proposed was not new, having been described years ago by Mr. James Swinburne; but its interest was revived by an experiment described by Mr. Mordey. The difficulty is to explain how a conductor buried in the iron of a slot-wound armature experiences very little mechanical force, though it is equally as efficient in developing electromotive force in a dynamo as if it

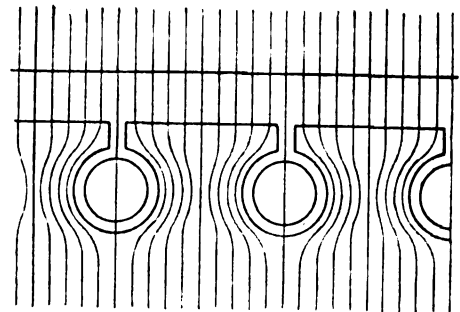


FIG. 1.

were exposed on the surface of an ordinary drum armature, and has just the same effect in producing torque in a motor.

The electromotive force developed in a conductor is simply proportional to the number of lines of force crossing it in a given time. The mechanical force on a conductor is proportional to the product of the current, and the density of the magnetic field in its own substance; and the difficulty lies in seeing how the magnetic field in the body of the slot-wound conductor can be so small that no appreciable force is exercised on the conductor, while, at the same time, it is cutting a field of sufficient intensity to generate a large electromotive force. The answer is, of course, that in a slot-wound armature the conductors are so shielded by the iron body in which the slots are cut that only a very small part of the total magnetic flux passes through them at any given instant, and the force acting on the conductor is correspondingly small; while at the same time the total flux cut by any conductor in the course of the revolution of the armature is not affected.

Figs. 1 and 2 are diagrams of the usual character, showing the distribution of the lines of magnetic flux near the air-gap in a slot-wound armature. The upper part in each figure represents parts of a magnet pole, while the conductors are shown in round slots cut in the body of the armature. The air-gap

*From the *Electrical Review*, London.

is shown straight instead of an arc of a circle for convenience in drawing. Fig. 1 gives the arrangement of the lines of magnetic flux when there is no current in the conductor. The field in the body of the conductor is extremely weak, but as the armature is rotated the lines of flux are carried across the conductor, moving slowly in the mass of the iron, but flashing across the slot at great speed. But no figure explains the movement as well as Mr. Swinburne's comparison of the action to the appearance of a row of railings passing behind a knot in the window of a railway carriage, producing an appearance similar to Fig. 1.

Fig. 2 gives the arrangement of the lines when a

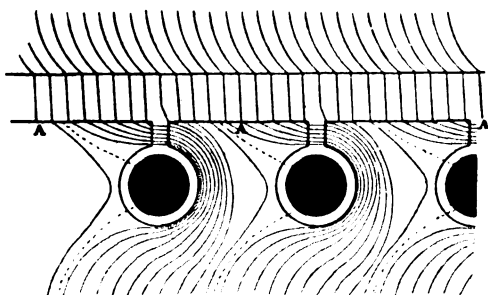


Fig. 2.

current is passing in the conductor. It is obtained by imposing on Fig. 1 a system of magnetic forces, circular about the conductors, producing distortion of the field. The distortion does not affect the reasoning already given about the forces acting on the conductors, and the electromotive forces developed; but the figure shows how it is that the weakness of the field in the body of the conductor does not affect the torque on the armature. The points of application of the forces which produce the torque lie on the surface of the armature, where the lines of force enter it from the ether, viz., along the surface, A A A. In Fig. 1 these lines enter the surface normally, and produce no torque; but when a current is started in the conductors, the lines of force in the air-gap become slightly oblique, as shown in Fig. 2, in consequence of the circular systems of magnetic forces about the conductors, and a torque is developed. The whole of the useful effect is obtained from the slight displacement in the air-gap. The large displacement of the lines in the body of the armature serves no useful purpose. The magnetic force in

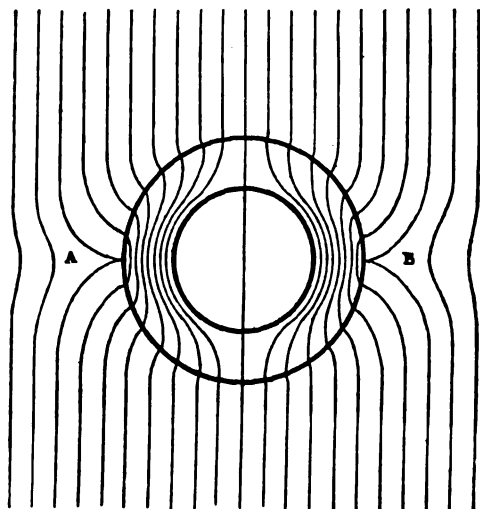


Fig. 3.

the air-gap, due to the current in the conductor of circular section, is at all points inversely proportional to the distance from the axis of the conductor, and is in no way shielded by the iron body of the armature.

Another advantage possessed by slot-wound conductors, that they are less heated by eddy currents than surface conductors, can only be due to a very steady movement of the lines of flux across the slots, so that all parts of any conductor are cutting lines at the same rate. It is no explanation to say that,

since the field in which the conductor lies is weak, even large percentage variations in its density are immaterial; for the absolute density has no relation to the generated electromotive force. The exact explanation of what is undoubtedly the fact, viz., the freedom of slot-wound conductors from eddy current heating, is not very clear.

A remarkable statement has been made by Prof. du Bois, from whose article in the *Elektrotechnische Zeitschrift* we extract the following passage:

"A ring magnet experiences a side thrust when in an external field, whose lines of force are in the same plane as the ring; and conversely it exerts a thrust in the opposite direction upon the supporter of the external field. This deduction, so astonishing at first sight, I have proved to be verified by experiment."

Though not expressly stated, it seems to be implied that the field is uniform, except so far as the ring distorts it, the ring homogeneous and uniformly magnetized, and the thrust experienced a continuous one, and not merely impulsive or ballistic on completing the connections. We take "side thrust" to mean a thrust in the plane of the ring, at right angles with the field, but it may mean a thrust in the direction of the axis of the ring. Each construction presents the same difficulties. Such a field and ring may be realized by permanent magnets, and by

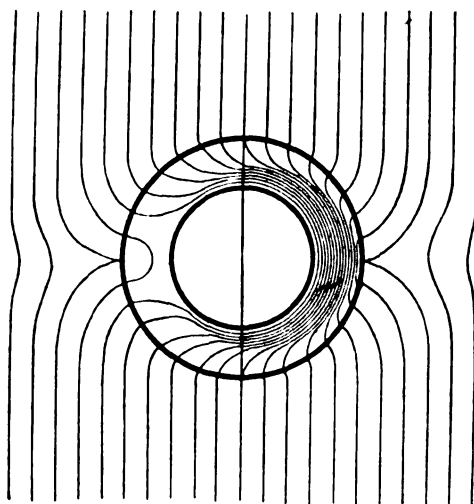


Fig. 4.

arranging the ring to turn about an axis "perpetual motion" is obtained.

Mr. James Russell disputes the truth of this "deduction" on experimental evidence, while it is totally opposed to conclusions drawn from the ordinary premises, which would lead us to reason somewhat thus. If an iron or steel anchor ring, unmagnetized, be introduced into a uniform magnet field, the field is distorted from its previous form in some way depending on the permeability of the ring and its position in the field. If the ring is placed with its plane parallel to the field, it will experience no force tending to move it in space. There will be forces tending to elongate it into an oval, but these would not produce any such effect as that discovered by Prof. du Bois. Now, without moving it, suppose the ring to become circularly magnetized. This magnetization, though it produces a new distortion of the field in the body of the ring, produces none in the field outside the ring, which retains the same form and distribution as before, so that the ring experiences no force.

Figs. 3 and 4 show the character of the field near the ring before and after its magnetization.

In these diagrams we have taken no account of the effect on the permeability of the different flux densities on the two sides of the ring. This would change the field distribution to a form that would be produced by an unmagnetized ring which is non-homogeneous, but symmetrical about the axis A B of Fig. 3, being less permeable on the side B than on the side A. This change of field taking place when the ring is magnetized would produce a sud-

den and transient force acting on the ring in the direction B—A, and it is possible that this is the effect Prof. du Bois has observed. His words do not exclude such a construction. The action would not occur with a circular or ring solenoid.

Mr. Mordey's suggested explanation of Prof. du Bois' observation published in the *Phil. Mag.* for

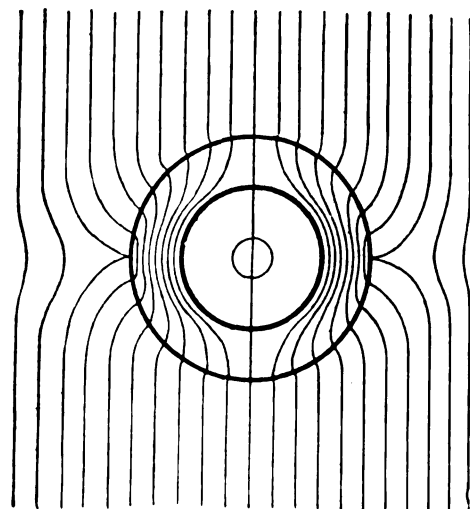


Fig. 5.

December is difficult to understand. He attributes it to the fact that a ring solenoid is equivalent magnetically, so far as the external field is concerned, to a single turn laid along the circle that forms the axis of the helix, but how such a ring can experience a side thrust in a magnetic field is not easy to see. One would expect only a tendency to turn into a plane perpendicular to the field.

Mr. James Russell describes also a number of interesting experiments on the forces exerted on a conductor carrying current in a magnetic field, when shielded by an iron cylinder. In one of these an iron tube is placed in a uniform magnetic field perpendicular to the tube, and a conductor is placed in the axis of the tube. On starting a current in the conductor, the iron shield tends to move sideways, i. e., at right angles to the field and to its own length, while the conductor experiences little or no force. Considered in connection with the action on the magnetized ring (Fig. 4), the result seems paradoxical, i. e., if this action be what we suppose, and Prof. du Bois is mistaken; for the effect

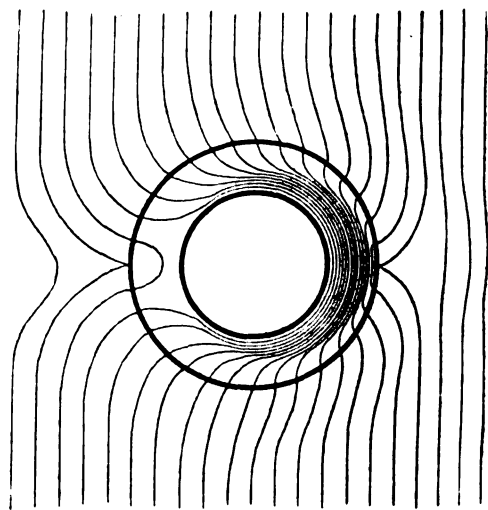


Fig. 6.

of the current on the iron tube is to magnetize it circularly, and to produce motion sideways, while no such motion occurs with a permanent ring magnet of the same form.

The explanation lies in the action of the current on the field outside of the iron tube, which is distorted by the current exactly as if the iron shield were absent, and is not affected by the circular distribution in the ring itself. In fact though the iron tube shields the conductor inside it from the action of the outside field, and prevents any force from acting on it, it does not shield the outside field from

the action of the current in the conductor. It seems possible that Prof. du Bois, in his experiment on the magnetized ring, may have led his current in such a way as to distort the field, and so produce the action on the ring, an action which would be more intense if the ring were not permanently magnetized and more permeable.

Fig. 5 shows the character of the distribution of the field when no current is passing in the conductor. It is, of course, similar to Fig. 3. Fig. 6 shows the field when a current is passing, and the field is disturbed outside the shield, tending to move it in the direction of the arrow. Comparison of Figs. 4 and 6 shows the difference between the conditions of Mr. Russell's experiment and the one we understand Prof. du Bois to describe.

Another point requires notice. A law of refrangibility has been repeatedly referred to, viz., that the

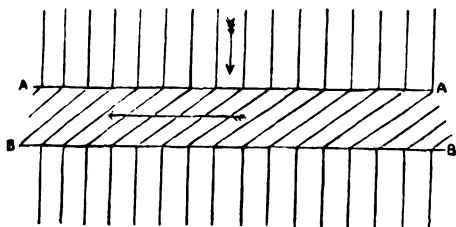


FIG. 7.

ratio of the tangents of the angles made by a line of magnetic flux with the normals on two sides of a surface separating two different media is equal to the ratio of their permeabilities. This only applies when neither medium is coercive, and the field of magnetic force is continuous at the surface in question; e. g., suppose in diagram Fig. 7, A A, B B, are infinite plane current sheets, A A coming up, B B flowing down normally to the paper. The space between A A, B B, is a uniform magnetic field in the direction of the arrow. Now, if the whole be placed in a uniform field perpendicular to the sheets, the lines of flow will take the direction shown in the figure, each of them bending sharply where they cross the current sheets, though the whole space is equally permeable.

So where lines of flow enter hard magnetized steel the law does not apply, and since all iron is coercive and other materials have practically the same permeability, the law is little more than a guide in drawing freehand certain classes of diagrams.

It is not suggested that the writers who have re-

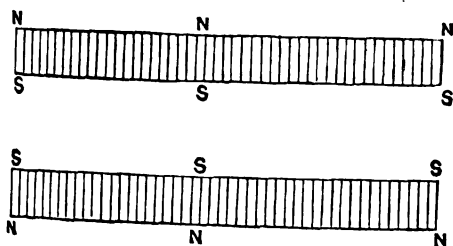


FIG. 8.

ferred to this law are not familiar with its limitations, but when laws are formally stated one is apt to think the statement is also complete.

I am tempted to suggest another paradox. A space is enclosed by a shield formed of bar magnets placed side by side with all their north poles outside and all their south poles inside. There can be no flux, and they consequently cease to be magnets.

For a simple case, consider the space enclosed between two infinite plane magnetic shells (Fig. 8). Along N N, N N, are north poles, and along S S, S S, south poles, the shells being made of small bar magnets placed side by side. There is no magnetic field anywhere. Have the bars ceased to be magnets?

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

LONDON NOTES.

[From our London Correspondent.]

Electric Mail Carts.

The Post Office authorities in London have been for some months past experimenting with steam, electric and other motor mail carts. A service of electrical delivery vans has now been inaugurated for carrying the mails between the General Post Office (St. Martins le Grand) and the West Central, Western and Paddington district offices. These vans were supplied by the London Electrical Cab Company, which has had a number of electrical cabs in service on the London streets for some time past and is now making arrangements for a greatly increased number to be in use.

Electric Lighting of the Thames Embankment.

The London County Council proposes to put down a special installation for the electric lighting of the Victoria Embankment and the Westminster Bridge, the annual maintenance cost of the plant being roughly estimated at \$17,600. The initial outlay will be \$126,500. Another cross-river in close proximity, the Waterloo, will be electrically lighted free of charge by a company in return for a concession to lay mains across.

Electric Lighting in London.

The London electricity supply companies seem to have reached very prosperous times. One company has declared dividends of 12 per cent. on its ordinary capital for the year 1897, and another 14½ per cent. These are the highest dividends ever paid in England for electricity supply, but there is promise of other London companies doing quite as well within a year or two. The City of London Electric Lighting Company, which supplies the City proper, has not yet declared its dividend, but it is rumored on the Exchange that the year's profits will be equal to 17½ per cent., though the dividend may not be more than 11 or 12 per cent. There is a good deal of dissatisfaction felt by this company's consumers at the high charges imposed notwithstanding the enormous business. The full charge of 8d. per Board of Trade unit is imposed for lighting, and all attempts to get it reduced have failed.

Lucan Tramways.

The Lucan Steam Tramways Company (Ireland) has for some time been considering the question of electric traction, and when recently the line was relaid for widening the gauge from 3 ft. to 3 ft. 6 in., advantage was taken of the opportunity to have the rails specially bonded ready for electric traction. The cost of equipping the lines for electrical working is estimated at about \$75,000 and the equipment can be done in four months.

Lecture on Electrical Engineering.

A series of lectures on electrical engineering has been arranged for to be given in the American Museum of Natural History, New York, during the month of February. The first of the series, on "Mechanical Sources of Energy," by Prof. Frederick R. Hutton, was delivered on Friday evening last and proved attractive to a quite numerous audience that would have been larger if the weather had been more favorable. The other lectures will be given in succession as follows: February 12, "Generation of Electrical Energy," by Prof. Francis R. Crocker; February 19, "Transmission of Electrical Energy," by Dr. A. E. Kennelly; February 26, "Utilization of Electrical Energy," by Prof. William A. Anthony.

The lectures begin at 8 o'clock on the evenings named. Tickets of admission are required, and these can be had without charge from the Secretary of Columbia University.

CANADIAN NOTES.

Application will be made to Dominion Parliament for an act to incorporate "The North Shore Electric Railway Company," to construct a railway on the north shore of the St. Lawrence, starting from Three Rivers in the province of Quebec, and through the district of Three Rivers and other districts in the province.

At the annual meeting of the shareholders of the Ottawa Electric Railway Company, last week, the annual report was submitted and considered satisfactory. It showed that 4,762,082 passengers were carried during the year, and 1,538,836 miles run, and that four quarterly dividends of 2 per cent. each were paid. A satisfactory increase in receipts was reported, especially since the month of September.

Rumors have been circulated respecting the approaching completion of arrangements whereby the street railway company of Montreal will obtain its power from the Chambly Power Company in future. Ever since the construction of the works of the Lachine Rapids Company and of the Chambly Company, the street railway people have been urged to substitute water for steam to operate their electric plant, it being represented that considerable economy in working expenses could thus be effected. The street railway people have been studying the question and are naturally prepared to make any bargain which can be advantageous to them, but so far no decision has been reached.

Application will be made to the Dominion Parliament at its present session for an act to incorporate a company to construct a railway to be operated by electricity or other power between London, Ont., and a point in or near the village of Lucan, and from Lucan to a point in or near Centralia in the township of Stephen, in the county of Huron, to a point in or near Grand Bend on Lake Huron; also with power to construct and operate telegraph and telephone lines, to take and use water for generating power, and to transmit and dispose of the power derived therefrom; to build, acquire and operate steam and other vessels and all necessary wharves and docks.

The Electrical Exhibition.—A Personal Exhibit by Prof. S. H. Short.

In addition to the superb exhibit which will be made of all its modern apparatus for the generation and use of electricity by the Walker Company of Cleveland, Prof. S. H. Short, its electrical engineer, well known as one of the most distinguished and successful pioneers in the electrical railway field, will make a personal exhibit. For some fifteen years Prof. Short has been actively engaged in railway design and invention, and as far back as 1885 organized a company in Denver which laid and operated a slotted conduit railway. His work will now be interestingly and richly illustrated by pictures, relics, models, old apparatus, etc. It will constitute one of the features of the Exhibition, and will attract wide attention and help secure for Prof. Short the recognition which certainly is his due.

Chicago Electrical Association.

The following papers are to be read before the above Association at Chicago on the evenings given: February 18—"Electricity in Medicine," by E. W. Jewell.

March 4—"Relationship of the Hunter and Tesla Patents," by A. Miller Belfield.

March 18—"The Autobiography of a Piece of Wire," by C. T. Gage.

April 15—"The Electric Railway," by W. R. Garton.

May 6—"The Enclosed Arc Lamp," by J. M. Hollister.

The annual banquet of the Association will be held on May 20.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The firm of Royce & Marean, electrical manufacturers, Washington, D. C., have been made defendants in a suit for injunction filed by the Diehl Manufacturing Company of New Jersey, which claims to have exclusive patent rights to certain improvements in electrical fans and appliances that Royce & Marean are manufacturing. The bill states that Edwin H. Bennett, Jr., a member of the Diehl Company, is the inventor of the improvements, and has transferred the patent rights to the company.

I. I. Spiro has been appointed receiver of the Lake Cities Electric Railroad Company of Michigan City. The receiver filed a bond in \$50,000 before assuming control of the road. The liabilities are estimated at \$30,000, with assets not known.

The General Electric Company has brought suit in the Circuit Court at Jacksonville, Fla., in which assumpsit damages for \$10,000 are claimed from the city in connection with the municipal lighting plant contract.

John L. Heins, president of the New Jersey Electric Railroad, commonly known as the Rutherford road, has been appointed receiver for that company, and the United States Court has served notice to the city authorities of Hoboken, N. J., restraining them from interfering with the operation of the road. The Hoboken officials had endeavored to compel the company to pay the \$20,000 which it had agreed to pay for its franchise by stopping the running of the cars on Sunday through the enforcement of an ancient "blue law," and the U. S. Court was appealed to by the company.

The full bench of the Supreme Court at Boston on the 27th ult. sustained the defendant's exceptions in the case of Carlos Wilson vs. Thomas W. Bicknel. The Boston *Transcript* gives the following statement of the matter in suit: "In accordance with an agreement entered into between the plaintiff and the defendant, the former on January 3, 1891, purchased of the latter 100 shares of stock of the International Port Electric Company of New York for \$1,000. By the terms of the agreement the defendant agreed to reimburse the plaintiff for any loss on the shares purchased by plaintiff on January 3, 1891, 'at or before the expiration of five years from this date, with interest at 6 per cent.' In September, 1895, the plaintiff offered the stock to the defendant, stating that it was worthless. The defendant refused to accept it. As a result the plaintiff brought suit against the defendant to recover \$1,000 with interest, in accordance with the agreement referred to. The Superior Court found for the plaintiff, and the defendant excepted and appealed. The Supreme Court declares that the action was prematurely brought, the five years not having expired. In the opinion written by Mr. Justice Lathrop, the Court says: 'A promise to pay a person "at or before" a day named is a promise to pay on the day named, the promisor having the option to pay before that time.'"

Death of William Habirshaw.

The death at Yonkers, N. Y., on the 30th ult., of Mr. William Habirshaw, only son of Dr. W. M. Habirshaw of the India Rubber & Gutta Percha Insulating Company, was a severe blow to his immediate family and to his business associates and its announcement was received with unfeigned sorrow by all his friends and acquaintances. His illness was of only a single week's duration, but his disease was pneumonia, and though combated by the best medical skill and the most devoted attendance, it gained the mastery and death resulted. The deceased was a young man of fine physique and engaging personality and had the reputation of being one of the best informed men in the wire insulation field and an expert in all laboratory work in that direction. His death, coming with such suddenness, is a deplorable affliction that must bear heavily upon his aged parents, and all who knew their son sincerely sympathize with them in their trouble.

Desirable Books.

Theo. Audel & Co. of 63 Fifth avenue, New York, the well known publishers, have recently brought out two exceedingly useful and valuable works.

One, entitled "The New Catechism of the Steam Engine," by Prof. W. Hawkins, treats of the steam engine and its appliances, and to this are added chapters on gas, gasoline and hot-air engines. "The New Catechism of Electricity," also by Prof. Hawkins, treats mainly of dynamo electric machines in a way that can readily be understood by anyone. Fully one-third part of the whole work has been devoted to the explanation and illustrations of the dynamo and particular directions relating to its care and management. All the directions are given in the simplest and most enticing way, to assist rather than confuse the learner.

As the price of these books is but \$2 each it will well repay any one interested in this subject to secure either one or both by addressing Theo. Audel & Co., 63 Fifth avenue, New York.

Personal.

All who are interested in the Electrical Exhibition—and that means the whole electrical trade—will be glad to learn that Mr. Max Osterberg has been retained by the Electrical Exhibition Company as Construction Engineer.

GENERAL NEWS.

What Is Going On in the Electrical World.

Chillicothe, O.—The plant and other property of the Chillicothe Electric Street Railway & Lighting Company have been transferred to a syndicate of local capitalists composed of William Poland, George A. Vaughners, Clark W. Story, Willard A. Story and John Tomlinson. The property is to be greatly improved.

Chicago.—The executive committee of the Illinois Street Railway Association at a recent meeting in Springfield instructed the secretary to request C. L. Bonney to prepare a paper embodying the views entertained by him relative to municipal franchises for street railways, to be read before the association at a meeting to be held in Chicago on the third Wednesday in May. Seventy-five of the 120 cars of the South Side Elevated Railroad have been already equipped with the new Sprague motors and the work is going forward at the rate of ten cars a week.

Cleveland, O.—President Emerson, of the city council, favors the organization in Cleveland of a bureau of electricity, to have charge of electric lights, telephone, telegraph, fire alarm and other wires.

Connersville, Ind.—The plant of the Connersville Gas & Electric Light Company has been purchased at foreclosure sale for \$8,000 by J. H. Sly, George Griffith and Thomas K. Egbert of New York. There is a bonded indebtedness of \$117,000 held by the Boston Loan & Trust Company.

Denver, Col.—The Denver City Railroad Company has applied to the city council for permission to change its system from the cable to the trolley.

Detroit, Mich.—The Detroit, Lake Shore & Mt. Clemens Railway Company has concluded negotiations for completing its line from Detroit to Mt. Clemens, Marine City and Algonac. The following officers have been elected: President Merrill B. Mills; vice-president, George S. Davis; secretary, Thos. N. Fordyce; treasurer, Frederick T. Ranney.

Fairmont, W. Va.—The Fairmont Electric Railway Company has been chartered and work on the road will begin at once. Col. A. Howard is the chief promoter.

Farmington, Ia.—At the city election held here a few days ago there were two propositions before the public: Shall the city of Farmington be permitted to put in electric lights or shall a company be permitted to put in a system of electric lights. The last proposition carried by a majority of 145.

Geneva, N. Y.—Justice Dunwell has appointed J. N. Johnston referee to sell the franchise and property of the Geneva Brush Electric Light & Power Company to satisfy a claim of the American Loan and Trust Company of New York.

Gridley, Ill.—There is an agitation here in favor of putting in electric lights and water works.

Grand Rapids, Mich.—The M. B. Wheeler Electric Company, located here, is to be organized into a stock company with increased capital.

Hazleton, Pa.—Surveyors have been staking out a route in the Conyngham Valley for an electric road to be run from this city to Wilkes-Barre. The project was conceived by Alvan Markle of Hazleton and by officers of the Wilkes-Barre & Wyoming Valley Railroad Company, but the greater part of the capital will, it is understood, be furnished by New York parties.

Kansas City, Mo.—The Tenth Street Cable Company has begun preparations to change its line from cable to electricity. When the change is made the line will be extended.

Kansas City, Kan.—Operations for the building of the Kansas City, Lawrence & Topeka Railway will be begun

at once and it is expected that the road will be completed to Lawrence before the end of the coming spring. Ex-Senator C. S. Brice is one of the financiers behind the scheme. The primary object of the railroad is to open the Kaw valley to a new cultivation and to change it from a continuous cornfield yielding annually from \$10 to \$20 per acre to a vegetable and fruit growing region which will return from \$200 to \$500 per acre per year. By means of the proposed road these products can be delivered into the Kansas City market in from fifteen to fifty minutes from the time they are gathered. By cutting the present immense tracts of land, some of them over 2,000 acres in extent, into five, ten and twenty acre tracts, it is expected that a great increase to the population of the Kaw valley will follow, and that it will become the greatest garden in the world. Apart from the details of operating the road, the company proposes to furnish electricity for manufacturing and lighting purposes to the cities and towns along the line. The work of securing the right-of-way is being vigorously pushed, and no difficulty is being experienced by the promoters in gaining concessions, because of the fact that the property holders are enthusiastically in favor of the new line.

La Porte, Ind.—Col. Sears of this city, representing a syndicate which proposes to build an electric railway from Goshen, Ind., to Danville, Ill., and to St. Louis, is going to London to interest English capital in the project.

Marquette, Mich.—After eight years of unsatisfactory municipal electric lighting and an expenditure of \$116,000, the light plant has at length been equipped with sufficient power to light the city.

Madison, Ill.—F. E. Allison, president of the Venice, Madison & Granite City Electric Railway, and E. J. Spencer have applied to the village board for a street railway franchise covering certain streets in Madison.

Middletown, Conn.—At a recent meeting of the directors of the Middletown Street Railway Company and of the Portland Street Railway Company it was voted to consolidate the two corporations, with \$135,000 capital stock, representing \$75,000 stock now outstanding of the Middletown Company, and \$60,000 outstanding stock of the Portland Company. J. M. Douglass of Middletown was elected president of the consolidated company, and Israel Kelsey of West Haven vice-president.

New Haven, Conn.—The Connecticut Electric Lighting Association elected the following officers at the annual meeting: President, James English of New Haven; treasurer, A. M. Young of Waterbury; secretary, Addison F. Hunie of New Haven.

New York.—Superintendent J. H. Robinson of the Third Avenue Railroad Company states that the main line of the road, the 125th street and Amsterdam avenue line and the branches will be equipped with electrical underground trolleys as soon as consents are obtained and the materials can be supplied.—Importers of electric light carbons, through R. F. Downing & Co., Custom House brokers, have filed a protest against the Appraiser's interpretation of the provision of the tariff law relating to imported carbon sticks. The law imposes a duty of 90 cents a hundred pieces, and importers have caused the pieces to be increased to about three times their original length for the purpose of lightening the duty, cutting them into the proper lengths after reaching this country. Appraiser Wakeman has deemed it to be his duty to count each one of these imported long sticks as three electric light carbons, hence the protest. The Customs board of classification gave a hearing on the matter on the 1st inst., and the question will be referred to Washington. (See *ELECTRICITY*, Vol. XIII, p. 212, "Duty on Carbons.")

Philadelphia.—At the annual meeting of the stockholders of the Wissahickon Electric Railway Company, on the 25th ult., they decided to accept the proposition to lease to the Roxborough, Chestnut Hill & Norristown Traction Company.

Pittsburg, Pa.—The Westinghouse Machine Company has just made a shipment of electrical machinery into the Klondike. The shipment consisted of two motors and the appliances necessary to operate a wire rope tramway across the Chilkoot Pass and was billed to the Dyea Transportation Company. A power house is being erected thirteen miles from the entrance to the pass and the power will be transmitted that distance. The Dyea Company will carry passengers and freight across the pass in baskets suspended on ropes. One of the latter will be operated by a thirty and the other by a fifteen horse power motor.

Port Jefferson, N. Y.—The Port Jefferson & Patchogue Traction Company have accepted the franchise for their road as amended by the highway commissioners. It is estimated that the road will cost about \$200,000, and the company will solicit stock to the amount of \$50,000.

Providence, R. I.—Mr. Randall of Scituate has introduced a bill in the House changing the name of the Cowesett Terminal & Transportation Company to Providence & Danielson Railway Company and authorizing the company to construct and operate an electric railway in the towns of Johnston, Smithfield, Scituate, Gloucester and Foster, with the assent of the town councils of said towns. The bill was referred to the Committee on Corporations.

Sac City, Ia.—A public vote is to be taken here shortly on the question of granting a franchise to an electric light company.

Springfield, Mass.—The question of municipal street lighting will be given a thorough investigation by the street lighting committee this year. The committee

will send inquiries to towns and cities that furnish their own light, and may inspect some lighting plants in person. The present contract with the electric light company does not expire until the spring of 1899.

St. Cloud, Minn.—The St. Cloud City Street Car Company's road and plant were bought in at foreclosure sale on the 29th ult. by Jared How of St. Paul, representing the bondholders, for \$5,410.52. The property cost originally \$40,000. The company will be reorganized.

Tacoma, Wash.—Machinery and men were sent on the last steamer to install the new electric plant at Skagway and Dyce for which C. B. Hurley of Tacoma made arrangements on his recent trip to Alaska. Bert Johnson, formerly city electrician of Tacoma, will have charge of the electric work.

Tonawanda, N. Y.—The opponents of the proposed municipal electric lighting plant scored an overwhelming victory at the election held here on the 29th ult., the vote being 339 against to 64 in favor of the proposition.

Warren, O.—Application has been made to the city council by the Trumbull Electric Railroad Company for an extension of its franchise to 50 years, instead of 25. The company contemplates placing larger cars on the line and otherwise improving it if the extension is allowed. The line runs from Warren to Niles, with two branches in Warren.

Wilmington, Del.—A deal has been consummated by which the Wilmington City Railway becomes the property of a syndicate organized by Clark & Co. Robert Wetherill of Chester, Pa., and Messrs. Widener and Elkins of Philadelphia are reported to be leading members of the syndicate.

Worcester, Mass.—An electric railroad project for a line from Worcester by way of Marlboro, Maynard, Concord and Chelmsford is attracting attention here and will probably be carried out.

Westwood, N. J.—C. M. Ottignon proposes to establish an electric lighting plant here, and is making a canvass of the town to ascertain what patronage he might expect.

NOTES FROM A CORRESPONDENT.

Schenectady, N. Y.—The General Electric works closed at 1 P. M. Saturday last and remained closed until Wednesday in order to permit the annual inventory of stock by the company.

Troy, N. Y.—The valuable electrical apparatus and instruments belonging to Doctors Scott and Fanning, who had a branch office in Gloversville, were destroyed in the Alvord House fire there.

Whitehall, N. Y.—At a meeting of the village trustees the contract for lighting the village by electric light has been awarded to E. L. Ashley of Fort Ann.

PERSONAL AND MISCELLANEA.

It is expected that by February 15 Siemens & Halske will have ready the electrical plant which is to light the City of Mexico. The entire plant will furnish 40,000 incandescent lights and 600 are lights for the city. Most of the machinery and supplies for this plant have been sent from New York, including poles and other apparatus.

James Heber Roberts, of St. Louis, although only fourteen years old, gives promise of becoming an electrical wizard, and has the St. Louis "Republic" says, received an invitation to place his inventions on exhibition at the Electrical Exhibition to be held in Madison Square Garden in May next, where space is to be given to juvenile work. Young Roberts is the son of the editor of the "American X-Ray Journal," and has done some surprising things in electrical construction.

The device of C. B. Martin, an electrician and son of Superintendent C. B. Martin, for keeping tally of the trolley cars crossing the Brooklyn Bridge consists of a series of magnets which are introduced in a special feed wire. This will lead to an insulated section of the regular trolley wire for a distance of sixty feet. Every time a car passes this section the instrument will register one toll in the collector's box. The trolley cars will be charged a toll of five cents for the round trip and the elevated companies will pay 12 cents for each of their cars. The revenue to the Bridge from this source will be between \$150 and \$250 a day.

The Mayor of Macon, Ga., in his annual address speaks well of the electrical department of that city. "This department," he says, "is rapidly growing to be one of the most important of the government. I am glad to say that it is kept to the highest standard by our electrician and the committee on electricity, and is pointed to by the best electricians as the best kept and best equipped system in the South. It is a pleasure to compliment this department on its splendid condition."

The Mackey mausoleum in Greenwood Cemetery, Brooklyn, has been equipped with electric apparatus for lighting and heating, and is probably the only private tomb in the world thus furnished. The use of heat and light in such a place might strike most people as fantastic, but the necessity is obvious enough when it is learned that the mausoleum contains a small chapel in which daily prayers are to be offered up for the dead. This magnificent tomb was erected to the memory of young John W. Mackey, the favorite son of the millionaire of that name, who was accidentally killed in France a few years ago and whose remains now rest within the structure.

President John Scullin of the Union Depot Railway Company at St. Louis, is so closely identified with the

progressive enterprises of that city that his name is as familiar there as almost daily mention of it in the local newspapers can make it, and the St. Louis "Star" gives this portrait of him: "John Scullin is one of the most pleasant and genuinely liked men in St. Louis. Although absorbed in business he is always ready to give attention to those who desire to consult him or talk with him, and in every way he shows the genial, affable man that he is. In appearance, he reveals in his pleasant smile and kind features his fine character, and that is perhaps the reason that he has frequently been appealed to for aid by entire strangers. He has done many good deeds of which he never speaks. His employees are all warm in praise of his kind treatment of them. The incident in the disastrous tornado that swept over St. Louis May 27, 1896, will never be forgotten by some of his men. Mr. Scullin's great electric plant on Missouri and Geyer avenues was razed to the ground, and several employees maimed and killed. While he set at once to work to rebuild the plant, he did not forget in his tremendous losses his unfortunate employees, but pensioned and provided for their families and saw that the injured were given every attention."

RECENT COMPANY ELECTIONS.

Atlanta Consolidated Street Railway Company, Atlanta, Ga.—President and general manager, M. E. Woodruff (to succeed Joel Hurt, resigned); treasurer, R. J. Lowry; superintendent, H. N. Hurt; secretary, T. K. Glenn; assistant superintendent, N. W. L. Brown; directors: R. J. Lowry, S. M. Inman, W. C. Sanders, H. M. McKeldin, E. Woodruff, M. L. Moore, H. E. W. Palmer, H. A. Inman, J. C. Payne, J. T. Dargan, Joel Hurt.

Electric Light & Power Company, Clinton, Ia.—Directors: A. G. Oatman, W. H. Talbot, J. B. Webb, W. A. Cotton, T. F. Reed, A. M. Price, J. A. Hannum.

Edison Electric Illuminating Company, Tiffin, O.—President, W. P. Noble; vice-president, J. M. Naylor; secretary, J. F. Bunn; treasurer, C. J. Yingling; directors: the officers and Joseph P. Myers, E. B. Hubbard and J. M. Greiner.

Fall River & Stone Bridge Electric Railway Company, Fall River, Mass.—President, William A. Tucker, Boston; treasurer, Philip T. Saltonstall, Milton; clerk, A. Lincoln Hamby; directors: W. A. Tucker, P. T. Saltonstall, A. L. Hamby, S. Gillman Bowen of Tiverton, G. B. Swift and Messrs. Stevens and Goff. The interests of the New York parties in the company have been transferred to Messrs. Tucker, Anthony & Co. of Boston. It is probable that the road will be consolidated with the Portsmouth & Middletown Company, thus making a continuous line from Newport to Fall River.

Greenfield Electric Light & Power Company, Greenfield, Mass.—President, F. E. Mills; treasurer, A. J. Doolittle; clerk, Charles W. Keith; auditor, Coyt F. E. Pierce; directors: Joseph W. Stevens, F. E. Wells, John H. Sanderson, N. S. Cutler and F. O. Wells.

Kansas City, Lawrence & Topeka Railroad Company, Kansas City, Kan.—President, E. B. Purcell, Manhattan, Kan.; secretary, John G. Johns, Houston, Tex.; assistant secretary, Edward G. Anderson, Kansas City, Kan.; treasurer, James Haggart, Kansas City, Mo. Directors: Henry McGrew and W. L. Wood, both of Kansas City, Kan., and E. E. Holmes and A. N. Gossett of Kansas City, Mo.

Lebanon & Annville Electric Railway Company, Lebanon, Pa.—Directors: Simon P. Light, H. H. Light, H. H. Kraider, A. Hess and Harry Nutting.

Mahoning Valley Railway Company, Youngstown, O.—Directors: G. Parmelee, G. Herrick, B. F. Miles, W. H. Lawrence, J. G. Butler, Jr., A. A. Anderson, C. F. Clapp, R. G. Sykes.

New London Electric Company, New London, N. H.—President, Le Roy F. Griffin; vice-president, William A. Messer; treasurer, Charles E. Shepard; clerk, Herman S. Adams; directors: Le Roy F. Griffin, Charles Woodward, Joseph M. Clough, Merrill Robie and James E. Shepard.

Newark, Somerset & Stratford Railway Company, Newark, O.—President, David Lee, Zanesville; secretary, P. C. Sneed, Chicago; directors: the officers and R. T. Davaries, J. R. McCortney and J. D. Culbertson, of Wheeling, W. Va.; Lincoln Richards and Franklin Ames, of Chicago; P. E. Werner, Akron, O.; John Reed of Mansfield, O., and L. M. Graham of Newark.

Newport Street Railway Company, Newport, R. I.—President, Gardiner B. Reynolds (in place of A. C. Titus, resigned); directors: Henry Darling of New York and George P. Magner of Newport, in place of Judge Baker and Anthony Sherman, resigned. The changes make the board practically the same as that of the Newport Illuminating Company, which owns a controlling interest in the railroad.

Norwich Gas & Electric Company, Norwich, Conn.—President, Edward N. Gibbs; vice-president, George E. Terry; treasurer, Morris E. Tyler; secretary, A. M. Young; directors: Edward N. Gibbs, New York City; George E. Terry, A. M. Young, Waterbury; Morris E. Tyler, New Haven; Garrett A. Hobart, Newark, N. J.; H. H. Osgood, William C. Mowry, Norwich.

Penn Yan Electric Light & Power Company, Penn Yan, N. Y.—President, Calvin Russell; vice-president and treasurer, C. T. Birkett; secretary, W. Stanley Bruen.

Reading Electric Light & Power Company, Reading, Pa.—President, Jerome L. Boyer; secretary and treasurer, J. K. Righter; directors: Jerome L. Boyer, Levi Quier, O. W. Stager, John G. Mohn, James Nolan, Henry Darling and J. K. Righter.

Wissahickon Electric Railway Company, Philadelphia—President, Peter Liebert; vice-president, Wm. Flanagan; secretary and treasurer, John Flanagan; directors: Wm. Johnston, James Christie, L. M. Jones, John Kenworthy and Ben Kenworthy.

Wilkes-Barre & Wyoming Valley Traction Company, Wilkes-Barre, Pa.—President, John Graham; secretary and treasurer, Theodore S. Barber; directors: B. F. Myers, Patrick Russ, Harrisburg; J. J. Patterson, Philadelphia; Robert McLean, Chambersburg; J. W. Hollenback, John Graham, Benjamin Reynolds, W. G. Eno and George N. Reichard, Wilkes-Barre.

COMMERCIAL PARAGRAPHS.

We would call our readers' attention to the advertisement of the Warren Electric & Specialty Company that is to be found in this issue. As is well known, this concern manufactures High Grade Anti-Trust Incandescent Lamps, one of the very best on the market. Persons purchasing from the above company can depend on being properly treated, as the Warren Electric & Specialty Company is in no way connected with the Lamp Pool of unsavory reputation. The price of their lamps is low for a good article, and although the Trust may possibly offer to furnish some kind of a lamp for less money we would strongly recommend any one in need of such an article to purchase it from the Warren Company.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The Frank B. Rae Engineering Company, of 134 Monroe street, Chicago, has for some time made a specialty of municipal engineering, and stands ready to furnish plans and specifications of waterworks, electric lighting plants or other works of like nature. Mr. Rae, who is at the head of the company, is an engineer of wide and practical experience. His work, especially in electric railways and elevator design, is well known, and whatever he advances in machine design is sure to be worthy of consideration. Of late he has devoted much of his time to bringing out a new form of electric vehicle which embodies several valuable improvements. It will not be long before this electric carriage will probably be extensively used.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedial Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

INCORPORATIONS.

Central Electric Company, Painesville, O. Capital stock, \$10,000.

The Dayton, Troy & Tippecanoe Electric Railroad Company, Cleveland, O. Capital stock, \$10,000.

The Colville Electric Light & Water Company, Colville, Wash. Capital stock, \$50,000. Incorporators: Julius Pohle, Henry Oakes, W. B. Aris and S. Douglas.

The Lurye-Lewis Electric Protective Company, New York City. Capital stock, \$5,000. Directors: H. J. Lurye, M. H. Lewis, Simon Schwarz and Joseph Schwarz, New York City.

The Electrical Railway Equipment Company, Washington, D. C.—to manufacture and supply equipment for electric railways. Capital stock, \$100,000. President, Archibald Greenless.

The People's Electric Light, Heat & Power Company, Ocean City, N. J. Capital stock, \$50,000. Incorporators: George Pfeiffer, Jr., George Barrett and J. Rufus Eastlock, all of Camden, N. J.

The Chestnut Hill Electric Company, Philadelphia, Pa.—Capital stock, \$10,000. Directors: Robert J. Moore, Daniel J. McNichol, Samuel F. Clovenger, William Macdonald, William N. Topham, Edward White, Samuel W. Ray, Philadelphia.

The Cicero & Harlem Railway Company, Chicago, Ill.—to build a line of railroad from the east line of the town of Cicero to the west line of Cook County, Ill. Capital stock, \$1,000,000. Directors: D. H. Louderback, Benjamin C. Stidger, Charles V. Weston, J. Charles Moore and Charles N. Whitehead.

The Main, Fifth and San Pedro Street Railway Company, Los Angeles, Cal.—to build a street railway in Los Angeles to be operated by animal, electric or cable motive power. Capital stock, \$500,000. Directors: Lovell White and Antonio Borel of San Francisco, and Frank Gibson, J. W. Hellman, J. C. Kays, J. Kuhrt and W. C. Patterson of Los Angeles.

The Snoqualmie Falls Power Company, Seattle, Wash.—to own and develop the power of rivers for electrical and manufacturing purposes; to own, acquire and operate cable and electric railways, municipal and suburban, and to engage in electric lighting and heating in the cities of Washington. Capital stock, \$500,000. President, Charles H. Baker. Among the directors are William T. Baker of Chicago, Sol. G. Simpson, R. B. Spencer and A. H. Anderson.

The Chicago & Desplaines Valley Electric Railway Company, Chicago, Ill.—to construct and operate an electric railway from a point in the town of Wheeling to some

TELEPHONE AND TELEGRAPH.

point in the town of Lemont, Ill. Capital stock, \$1,000,000. President, Charles D. Evans of Chicago; vice-president, Clayton E. Crafts of Chicago; secretary and treasurer, Philip H. Gray of Maywood; directors: Henry G. Foreman, Clayton E. Crafts, Charles D. Evans of Chicago, Philip H. Gray and W. M. Hulbert of Maywood.

The Sandusky, Norwalk & Toledo Railway Company, Sandusky, O.—to build an electric road from Sandusky to Norwalk and from Sandusky to Toledo. Capital stock, \$1,000,000. Incorporators: Charles Rudd, W. W. Graham, A. J. Stoll, Henry G. Fowler and W. E. Guerin, Jr., all of Sandusky.

The Fort George & Eleventh Avenue Railroad Company, New York City—to operate with power other than steam a road on the Boulevard or Eleventh Avenue from Kingsbridge to 175th street. Capital stock, \$10,000. Directors: John T. Little, Jr., D. S. Johnstone, Charles R. La Rue, Fred C. Garrick, Thomas Hanlon, Jr., and Harry J. Turner of New York City, C. M. Cumming of Yonkers, J. Howard Brouse of Mount Vernon, and Charles A. Gilbert of White Plains.

The La Grange, Warrenville & Fox River Electric Railroad Company, Chicago, Ill.—to construct and operate an electric railroad in Cook, DuPage and Kane counties, Ill. Capital stock, \$100,000. Incorporators: George W. Waite, A. C. Allen, M. C. Covell, A. H. Kemman, Frederick Poulsen, J. W. Kruger and Edward S. Ely, all of LaGrange; James M. Vallette, B. B. Boecker, I. N. Murray, Willard Scott, George Remps and C. L. Schwartz of Naperville; William J. Manning, John McKee and A. T. Jones of Warrenville; Henry W. Grote, J. J. Cole, Ira Brown, Elbert H. Gary and George W. Brown of Wheaton; George W. Wilson of Hinsdale and J. M. Vallette of Naperville.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 1, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

598,099. Station Indicator. Dudley C. Jones and Jacob M. Jones, St. John, Ky. Filed March 26, 1897.

598,181. Conductor for Electric Railways. Georg Ritter, Stuttgart, Germany. Filed Oct. 16, 1896.

598,193. Mechanism for Starting, Stopping and Controlling Speed of Motors of Electric Cars. Frank H. Foster, Brooklyn, N. Y. Filed Aug. 12, 1897.

598,200. Electrical Conductor. Louis C. Werner, Broadbrook, Conn. Filed June 15, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

598,198. Electric Lamp for Bicycles. Peter A. Dowd, Boston, Mass., assignor to the Dowd Electric Company, same place. Filed July 10, 1897.

598,218. Adjustable Support for Incandescent Lamps. William J. Going, Amsterdam, N. Y., assignor of one-half to Leonard Weldon, same place. Filed May 26, 1897.

598,219. Support for Incandescent Lamps, etc. William J. Going, Amsterdam, N. Y., assignor of one-half to Leonard Weldon, same place. Filed July 21, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

598,092. Alternating Current Motor. Alexander Heyland, Frankfurt-on-the-Main, Germany. Filed Dec. 29, 1896.

598,160. Electric Fire Alarm. Circuit and Signal-Box. Lewis G. Rowand, Camden, N. J., assignor to the Universal Fire Alarm Company of New Jersey. Filed Jan. 5, 1897.

598,208. Electric Meter. Carl D. Raab, Kaiserslautern, Germany. Filed Dec. 30, 1896.

598,209. Electric Meter. Carl D. Raab, Kaiserslautern, Germany. Filed June 24, 1897.

598,211. Brush-Holder. August J. Oehring, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 30, 1896.

598,272. Instrument Winding Device. August J. Oehring, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 12, 1896.

598,276. Self-Restoring Annunciator. Josef Steiner, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed May 23, 1896.

598,328. Terminal Head for Electrical Conductors. Charles H. Sewall, Chicago, and Henry E. Procuier, Oak Park, Ill. Filed Aug. 22, 1896.

598,338. Electric Circuit Controller. William T. Budd, Charleston, S. C. Filed Aug. 30, 1897.

598,410. Fire and Burglar Alarm System. Charles P. Boston, Milton, Pa., assignor to the Boston Automatic Burglar & Fire Alarm Company, same place. Filed April 27, 1897.

ELEVATOR APPARATUS.

598,037. Electric Control Device for Elevators. John D. Hilder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed April 18, 1896.

TELEPHONE AND TELEGRAPH APPARATUS.

598,172 and 598,183. Telephone System. Charles A. Barron, Robert T. Reid and James McDonnell, Tacoma, Wash., assignors of one-half to Frank C. Cardin and John T. Bibb, same place. Filed April 5, 1897, and May 7, 1897.

598,285. Telephone Apparatus. Frank B. Cook, Chicago, Ill. Filed March 25, 1895. Renewed Dec. 16, 1897.

MISCELLANEOUS.

598,109. Insulating Attachment for Electrical Connectors. Richard P. Osgood and John D. Osgood, Methuen, Mass. Filed June 28, 1897.

598,180. Apparatus for Electrolytically Producing Zinc. Carl Hoepfner, Giessen, Germany. Filed Oct. 7, 1892.

598,193. Apparatus for Electrodeposition of Gold and Silver. Emile Andreoli, London, England. Filed Oct. 1, 1895.

598,303. Electric Heater. Elmor E. Cruzen, Baltimore, Md. Filed Aug. 7, 1897.

598,313. Electrodeposition of Lead. Ernest P. Clark, New York City, assignor of one-half to Charles S. Campbell, same place. Filed June 8, 1897.

598,316. Electric Gas-Lighting Apparatus. Christian Elckman, Indianapolis, Ind. Filed July 3, 1897.

598,318. Electric Furnace. James E. Hewes, Philadelphia, Pa. Filed April 27, 1897.

598,429. Electric Cigar-Lighter. William F. Kessler, Auburn, Ind. Filed July 22, 1897.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

In Honor of the First Telephone Exchange.

The first telephone exchange in the world was opened in the Boardman building in New Haven, Conn., on January 28, 1878, and in commemoration of the event a banquet was given at the New Haven House in that city on the 28th ult. The president of the New England Telephone Company, Morris F. Tyler, presided, and among those present were General Superintendent E. B. Baker, the assistant superintendents, and a number of electrical experts and long service employees of the company; William D. Sargent, vice-president of the New York & New Jersey Telephone Company; D. J. Carson of the Southern Bell Telephone Company; Samuel Ivers, treasurer of the Southern Massachusetts Telephone Company of New Bedford; Gen. E. P. Meany, one of the managers of the Long Distance Telephone Company, with headquarters at New York; W. J. Denver, assistant manager of the New England Telephone Company of Boston, and Thomas D. Lockwood of Boston. The intellectual part of the feast consisted of informal speeches treating of the inception and wonderful growth of the telephone business and enlivened by anecdotes of men and incidents connected with the industry. The New Haven News, from whose account the foregoing is collated, states that George W. Coy and H. P. Frost established the telephone business in New Haven under the name of the District Telephone Company. They obtained the idea of a switchboard from Isaac B. Smith of Hartford, and were guided in the new enterprise by Morris F. Tyler, who acted as counsel for the new firm. In May, 1880, the Connecticut Telephone Company was organized with Marshall Jewell, Charles L. Mitchell, H. P. Frost and Morris F. Tyler as members. Mr. Tyler is the only survivor.

At Richmond, Va., on the 1st inst., Judge Simonton in the Court of Appeals handed down a decision in the case of the city of Richmond against the Southern Bell Telephone and Telegraph Company. The case involved the act of Congress of 1866 declaring that the streets of a city are post roads of the United States. Judge Simonton holds that, while the act specifies only telegraph companies as entitled to its provisions, a telephone is to all intents the same thing and therefore entitled to its privileges. The Bell Telephone Company's charter having expired, the city exercised its stipulated right to revoke it, but was enjoined from interfering with the company's poles and wires. The effect of the decision is to modify the injunction so as to prevent the city from driving the company from its streets, but the city is to retain its police power over it.

O. K. Dickson Walsh, manager of the Kinloch Telephone Company, St. Louis, stated at a recent meeting of members of the Real Estate Exchange that his company expects to have its system of telephones in use in St. Louis and East St. Louis not later than August 1 of the present year. He said also that the Kinloch company had leased its exchange headquarters in St. Louis for twenty years and had no intention of selling out, leasing or consolidating with any other company; it is successfully operating systems in Detroit, Little Rock and Fort Wayne, Ind. Mr. Durant, the Bell manager, also addressed the Real Estate men, explaining the change in the form of contracts adopted by his company, and promising a much improved service. He said the Bell Telephone Company has between 4,000 and 5,000 telephones in use in the business houses of St. Louis.

The Minneapolis city council has passed a resolution granting to the Minnesota Central Telephone Company the right to enter the city of Minneapolis for the purpose of operating its long-distance telephone system. By the ordinance the company will be permitted to lay its wires into the city and maintain public telephone stations and instruments for private use at such points as may be authorized and designated by the city council. The ordinance does not permit of the establishment of a central office or a general local system in the city. The company is to confine itself entirely to long-distance business, and when a business man desires one of its 'phones placed in his establishment, authority must be first secured from the city council before the instrument may be so placed.

The House of Representatives on the 1st inst. adopted an amendment to the District of Columbia appropriation bill, fixing the price of telephones in the District of Columbia at \$50 per year when on a single wire and with proportionate decrease on wires on which one or more instruments are in use. The House has several times adopted such an amendment, but the Senate has invariably defeated it. The price for a single-wire telephone is now \$100, and the residents of Washington think they are imposed upon.

A special to the Pittsburgh papers from Uniontown, Pa., states that the new telephone company establishing competing exchanges in Uniontown, Connellsville and at other points has let the contract for about \$40,000 worth of switchboards and telephones for its new stations to the

Stromberg-Carlson Telephone Manufacturing Company of Chicago, and expect to have exchanges in operation early this month. It has contracts for 400 subscribers in Uniontown and 350 in Connellsville.

Recently at St. Paul, Minn., State Treasurer Koerner received a check for \$20,772 from the Western Union Telegraph Company in payment of the tax for 1897 on its property in the State of Minnesota. The State Board of Equalization assessed the company at \$865,500. The tax rate is 24 mills. A printed notice accompanied the check, stating that the company paid the tax under protest, conceding neither the justness of the tax nor the right of the State to collect any tax.

The Missouri & Kansas Telephone Company has purchased the local telephone line from Guthrie, Ok., to Chandler and Stillwater, and will at once extend the line to Wellston and Stroud. They will complete their line from El Reno and Oklahoma City, and at once continue north to Arkansas City, giving direct connection with Wichita and Kansas City.

The Onancock (Va.) Telephone Company has decided to extend its line to Keller Station where it will unite with the line of the Harborton Telephone Company. This will put Onancock in direct communication with nearly all the villages and towns in the central and southern part of Accomac County. It is thought that arrangements will soon be made to connect with the Hall and Atlantic Telephone Companies, whose wires cover the northern part of the county.

Josiah Holbrook, of Chicago, president of the National Telephone Company, was in St. Louis a few days ago and told a *Chronicle* reporter that he had his eye on several live towns in the vicinity of St. Louis, and may endeavor to secure telephone franchises from them. He said: "The independent companies are becoming stronger every day and are giving the Bell Company a great fight."

On the 29th ult. all the local express offices at Grand Rapids, Mich., ordered their Bell 'phones out. The express companies have agreed, as a measure of economy, to limit their telephone service in each town to one system, and have left the selection with local agents. The home company is selected at Grand Rapids. It is believed other business houses will follow suit.

The Citizens' Telephone Company at Columbia, Tenn., has not only succeeded in raising the money necessary to pay off its debt of \$4,400, but has secured \$1,100 additional, which will be used in putting in a new switchboard and making other improvements to the plant. That company deserves success.

The Dominion Government has decided to extend its telegraph service from Quevelle to Teslin Lake and Dawson City, 1,322 miles. The route is that followed by the Russian American Telegraph, abandoned in 1868.

The Gilliland Company at Adrian, Mich., will make the Smith Vassar automatic telephone, the inventors having decided to locate their business at Adrian.

The Astoria Telephone Company, Astoria, Ill., has certified to a dissolution of organization and made a surrender of charter.

A stock company is being organized at McGhee, Tenn., to build a telephone line from Vomore to Loudon and also an independent line from Vomore to Madisonville.

New Companies Incorporated.

The Oneida Telephone Company, Oneida, N. Y. Capital stock, \$15,000. Directors: Oliver Watson, T. C. Becker, Edward Michaels, and Henry Koons, Buffalo; Martin Cavona, E. E. Coe and J. T. Durham, Oneida.

The Franklin & Fulton Telephone Company, McConnellsburg, Pa. Capital stock, \$1,480.

The Electric City Telephone Company, Great Falls, Mont. Capital stock, \$20,000. Incorporators: G. H. Stanton, S. R. Jensen, M. L. Lane, G. W. Dunlap and C. L. Herzog, all of Great Falls. The company is operating a line in Great Falls.

The Litchfield Telephone Exchange, Litchfield, Minn. Capital stock, \$10,000. Incorporators: T. F. McClure, F. E. Bissell, S. W. Leavitt, P. E. Hanson, L. J. Lundemo, J. B. Atkinson and H. I. Peterson.

The Meredith Telephone Company, Delhi, N. Y.—to maintain a telephone line in Delaware and Otsego counties. Capital stock, \$2,000. Among the directors are Thos. M. Ware, J. Milo Graham and Porter Dean, of Meredith.

The Jersey City Contracting Company, Jersey City—to build telephone and telegraph lines. Capital stock, \$100,000. Incorporators: John E. Wright of New York and Fred L. Benzon of Newark, N. J.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authorized	Issued.				
Albany, N. Y.—Feb. 7:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1 1/2 % Q., Aug. '97.	133 1/2	134 1/2
Troy City Railway Co.	100	2,000,000	1 % Q., Sept. 10, '97.	70	71
Traction Co. (Saratoga)	100	50,000			
Allentown, Pa.—Feb. 7:					
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000		80
Bridgeport, Conn.—Feb. 7:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1 % Aug., '97.	45	60
Baltimore, Md.—Feb. 7:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5 % S., July 2, '97.	99	70
Baltimore Traction Co.	25	10,000,000	5,750,000 1 1/2 % Q., Jan., '97.	237	241
Central Ry. Co. of Baltimore City	50	800,000	300,000 6 % A., 1897.	80	82 1/2
City & Suburban Ry. Co.	50	4,000,000	1,000,000 2 % A., Jan., '97.	48	
Boston, Mass.—Feb. 7:					
New England Street Ry.	25	5,000,000	1,081,925 1 % Q., Jan. 15, '97.		
North Shore Traction Co.	100	4,000,000	4,000,000 3 % S., Oct. '96.	10	20
North Shore Traction Co. pfd.	100	2,000,000	2,000,000 6 % S., A. & O.	75	77
West End Street Ry. Co.	50	10,000,000	9,085,000 1 % S., Oct., '97.	84 1/2	84 1/2
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000 4 % S., Oct. 1, '97.	103	104
Brooklyn N. Y.—Feb. 7:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,000,000 2 1/2 % Aug. 1, 1897.	180	190
Brooklyn Rap. Transit Co. tr. cert.	100	20,000,000	20,000,000	397	40
Brooklyn Heights Railroad	100	200,000			
Brooklyn City RR.	100	12,000,000	12,000,000 2 1/2 % Q., July, '97.	209 1/2	210
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000		
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000 1 1/2 % July 1, '97.	150	160
Kings County Elevated	100	4,750,000	4,750,000	2	8
Kings County Traction Co.	100	4,500,000	4,500,000 1 % July 26, '97	47 1/2	50
Nassau Electric Railroad	100	6,000,000	6,000,000	42	
Atlantic Avenue Railroad	50	2,100,000	2,000,000		
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000	74	80
Buffalo, N. Y.—Feb. 7:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	60	62
Buffalo Railway Co.	100	6,000,000	5,370,500 1 % Q., Sept., '97.	80 1/2	82
Columbus O.—Feb. 7:					
Columbus Street Railroad	100	3,000,000	3,000,000 1 % Q., Feb., '97.	48	46
Columbus Central Street Railroad	100	1,500,000	1,500,000		
Charleston, S. C.—Feb. 7:					
Charleston City Ry. Co.	50	100,000	100,000 3 % S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000		
Chicago, Ill.—Feb. 7:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 3 % Q., Sept. 15, '97.	243	245
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800		
Lake Street Elevated RR.	100	10,000,000	10,000,000	15	15 1/2
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	3 1/2	3 1/2
Met. West Side El. const. stk.	100	15,000,000	2,500,000		
North Chicago Street RR.	100	10,000,000	6,600,000 3 % Q., Oct., '97.	226	230
North Chicago City RR.	100	10,000,000	2,190,000		
South Chicago City Railway	100	2,000,000	1,603,200		
West Chicago St. RR. Co.	100	20,000,000	13,189,000 1 1/2 % Q., May, '97.	100	100 1/2
Chicago West Div. Ry. guar.	100	1,250,000	624,900 35 %		
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000 5 % S.		
Cincinnati, Ohio.—Feb. 7:					
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000	20	
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000 2 1/2 % Feb., '98.	25	
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	23	25
Cincinnati Street Ry. Co.	100	18,000,000	14,000,000 1 1/4 % Q., July, '97.	115 1/2	116
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1 1/4 % Q., Oct., '96.		
Cleveland, Ohio.—Feb. 7:					
Akron, Bed. & Cle. Elec. Ry.	100	1,000,000	1,000,000	40	42
Cleveland City Ry.	100	8,000,000	7,600,000 3 1/2 % Q., Oct., '97.	59	60
Cleveland Electric Ry.	100	12,000,000	12,000,000 1 1/4 % Q., Oct., '97.	51 1/2	52 1/2
Detroit, Mich.—Feb. 7:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100 1/2	
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000 5 % July, '96.	175	
Rapid Railway Co.	100	250,000	250,000		100
Detroit Electric Railway	100	1,000,000	1,000,000		
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton O.—Feb. 7:					
City Railway Co.	100	1,500,000	1,470,600 1 1/4 % Q., Oct. 1, '96.	100	102
City Railway Co. pfd.	100	600,000	600,000 1 1/2 % Q., Oct. 1, '96.	140	145
People's Street Railway	100	1,000,000		100	

PASSENGER RAILWAYS.

NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authorized	Issued.				
Hartford Conn.—Feb. 7:					
Hartford Street Ry. Co.	100	\$2,000,000	\$200,000 3 % S., July, '97.	140	--
Hartford & West Hartford RR.	100	1,000,000	247,000		
Holyoke Mass.—Feb. 7:					
Holyoke Street Ry. Co.	100	400,000	400,000 3 1/4 % A., July, '97.	200	205
Hoboken, N. J.—Feb. 7:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8 %, 1892.	70	--
Indianapolis, Ind.—Feb. 7:					
Citizens' Passenger Ry.	....	5,000,000	5,000,000	25	26
Lancaster, Pa.—Feb. 7:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000		
Lancaster & Col. Electric Ry.	....		87,500		
West End Street Railway	....			
Louisville, Ky.—Feb. 7:					
Louisville Ry.	100	4,000,000	4,000,000 1 1/4 % A., '97.	35	37
Louisville Ry. 5 % pfd.	100	2,000,000	2,000,000 2 1/2 % S., Apl. 1, '97.	94	96
Minneapolis, Minn.—Feb. 7:					
Twin City Rapid Transit. com.	100	17,000,000	15,010,000	17 1/2	20
Twin City Rapid Transit. 7 % pfd.	....	8,000,000	1,137,200 1 1/4 % A., '97.		100
Montreal, Canada.—Feb. 7:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8 % S., M. & N.	248	1250
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1 1/4 % S., J. & J.	98 1/2	99 1/2
Memphis, Tenn.—Feb. 7:					
Citizens' Street Railway Co.	100	1,500,000	1,500,000	15	--
New Haven, Conn.—Feb. 7:					
Fair Haven & Westville RR.	25	1,500,000	900,000 4 % S., Sept. '96.	57	60
New Haven Street Railway Co.	100	1,250,000	1,000,000 2 1/2 % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000		
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—Jan. 31:					
Canal & Claiborne RR. Co.	40	240,000	240,000 2 1/2 % S., July, '96.	140	150
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1 1/2 % Q., Apl., '97.	121 1/2	126
New Orleans Traction Co. com.	100	5,000,000	5,000,000	2 1/2	4
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000 6 % S., J. & J.		15
Crescent City RR.	100	2,000,000	2,000,000 3 % S., July, '97.		62
New Or. City & Lake RR. guar.	100	2,000,000	2,000,000 4 % S., July, '97.		95
Orleans Railroad	50	500,000	185,000 1 1/2 % S., June, '94.	10 1/2	11
St. Charles Street Railway	50	1,000,000	1,000,000 1 1/2 % A., '97.	55	57
New York—Feb. 7:					
Central Crostown RR.	100	600,000	600,000 2 1/2 % Q., July, '97.	200	
Christopher & 10th Sts. RR. guar.	100	650,000	650,000 2 % Q., Apl., '97.	155	165
Dry Dock, E. B'rd'w' & Battery RR.	100	1,200,000	1,200,000 1 1/2 % Q., Feb., '97.		190
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000 1 1/4 % Q., July, '97.	153 1/2	154
Bleecker St. & Fulton Ry. guar.	100	900,000	900,000 4 % A., July, '97.	33	35
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2 1/2 % Q., July, '97.	205	209
Gen. Park, N. E. Rivers RR. guar.	100	1,800,000	1,800,000 2 % Q., July, '97.	175	180
Eight Avenue RR.	100	1,000,000	1,000,000	320	
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2 % Q., Aug., '97.	330	350
Ninth Avenue RR.	100	800,000	800,000	180	190
Sixth Avenue RR.	100	2,000,000	2,000,000	195	210
Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4 1/2 % Q., Aug., '97.	300	325
Second Avenue RR.	100	2,500,000	1,862,000 1 1/4 % Q., Jan., '97.	160	170
Third Avenue RR.	100	12,000,000	10,000,000 2 % Q., Aug., '97.	177	179
42d St. Manhat'le & St. Nich. Av.	100	2,500,000	2,500,000	70	73
Union (Huckleberry) Ry.	100	2,000,000	2,000,000	190	210
Newark N. J.—Feb. 7:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	46	46 1/2
Newark Passenger Ry.	100	6,000,000	6,000,000		
Rapid Transit Street Ry.	100	501,000	504,000 1 1/4 % A.	180	185
Pittsburg, Pa.—Feb. 7:					
Allegheny Traction Co.	50	500,000	500,000		43 1/2
Consolidated Traction Co. com.	50	15,000,000	15,000,000 2 % Jan., '95.	18	
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000 3 % May, '97.	46 1/2	
Central Traction Co.	50	1,500,000	1,500,000		
Citizens' Traction Co.	50	8,000,000	3,000,000 6 % A.	61 1/2	62
Duquesne Traction Co.	50	8,000,000	3,000,000		
Pittsburg Traction Co.	50	2,500,000	1,900,000 3 % Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,000,000	1,400,000 2 1/2 % July, '97.	24	24 1/2
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,904,800 2 % Aug., '95.		
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000 1 % Jan., '96.	18 1/2	19
Pittsburg & West End Ry.	50	1,500,000	1,500,000 3 % A., June 30, '96.		
Second Avenue Traction Co. com.	50	4,000,000	14,000,000		
Suburban Rapid Transit Co.	50	800,000	200,000		

* Unlisted. † Ex div.

b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.

i \$250,100 of stock owned by North Chicago Street Railroad Company.

j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

k 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.

l Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street &amp

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Feb. 7:							Boston, Mass.—Feb. 7:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2% Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4% Q. Oct., '97	267 1/2	268
Northampton, Mass.—Feb. 7:							Erle Telegraph & Telephone Co.....	100	10,000,000	10,000,000	1% Q. Aug., '97.	71	72
Northampton Street Ry.....	100	800,000	225,000	5% A., July, '97.	165	175	New England Telephone Co.....	100	10,894,600	10,804,600	\$1.25 sh. Q.	130 1/2	131 1/2
Omaha, Neb.—Jan. 31:							New York.—Feb. 7:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1% Q.	9 1/2	..
Paterson, N. J.—Feb. 7:							*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1% Q.	104	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	83	85	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	180	190
Providence, R. I.—Feb. 7:							Franklin Teleg. Co..... 2% guar.	100	1,000,000	.....	1% S.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	60	65	Erle Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q. Aug., '97.	71	71 1/2
Philadelphia.—Feb. 7:							*Gold & Stock Teleg. Co. guar. 6%	100	5,000,000	.....	1% Q.	107 1/2	110
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	2,000,000	.....	14 1/2	..	*International Ocean Tel. Co. guar. 6%	100	8,000,000	.....	1% Q.	106	..
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2% Q. July 15, '97.	44	45	Mexican Telephone Co.....	100	2,000,000	.....	.....	60	70
Hestonville, Man. & Fairmount.....	50	533,900	533,900	3% S. July 15, '97.	61	65	*New York & New Jersey Tel. Co....	100	5,000,000	8,723,000	1% Q. July, '97.	150	151
Fairmount Pk. & Had. Pass. Ry.....	50	300,000	300,000	3% Feb. 1, '97.	63	66	*Pacific & Atlantic Teleg. guar. 4%	25	2,000,000	.....	2% S.	71	76
Union Traction Co. \$12 1/2 pd.	50	30,000,000	5,986,095	.....	15 1/2	15 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	..	..
Electric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Teleg. Co. guar. 5%	25	950,000	559,525	2% S.	90	96
*Citizens' Passenger Ry.....	50	500,000	.....	\$3 share Q.	300	..	*Commercial Union Telegraph Co....	25	500,000	500,000	8% S. July 1, '97.	117	119
*Frankford & Southwark Pas. R.	50	1,000,000	1,187,500	\$14 share A.—Apr. 97	375	..	Western Union Telegraph Co.....	100	97,870,000	97,870,000	1% Q. Oct., '97.	92 1/2	92 1/2
*Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	40	..	*Div. guar. by Postal Teleg. Co.	..	..	..	..	..	..
*Lombard & South Streets Ry.....	25	1,000,000	1,000,000	A. & O.	90 1/2	..	Miscellaneous.—Feb. 7:						
*Second & Third Streets Ry.....	50	1,000,000	771,076	\$9 share A. Mar. 97	260	..	American Dist. Teleg. (Phila.).....	25	400,000	.....	.....	14	..
*People's Traction Co.....	50	10,000,000	760,000	3% A. April, '97.	132	..	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	174 1/2	175
*Germanantown Passenger Ry.....	50	1,500,000	1572,800	\$5.25 share—1897.	132	..	Chesapeake & Potomac Teleg. Co....	100	.....	.....	.....	61	65
*Green & Coates Passenger Ry.....	50	500,000	150,000	3% July, 1897.	132	..	Chicago Telephone Co.....	100	.....	.....	.....	202	..
*People's Passenger Ry..... com.	25	1,500,000	174,000	.....	..	..	Central Dist. Prtg. & Telg. Co. (Pha.)	100	750,000	750,000	.....	72	78
*People's Passenger Ry..... pfd.	25	750,000	127,402	.....	..	..	Empire & Bay States Telegraph Co....	100	2,000,000	2,000,000	1% Q.	65	66
*Philadelphia Traction Co.....	50	30,000,000	120,000,000	4% S.—Apr. 1, '97.	82 1/2	83	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	112	115
*Catherine & Bainbridge St.....	50	1,000,000	400,000	6% A.—Mar. '97.	185	145	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2% Q.	87 1/2	..
*Continental Pass. Ry. guar.	50	1,000,000	580,000	\$9 share—July, '97.	185	145	Providence (R. I.) Teleg. Co.....	50	.....	.....	.....	120	122
Empire Passenger Ry. Co.....	50	600,000	600,000	.....	..	..	Southern New Eng. Teleg. Co.....	100	8,000,000	.....	.....	..	..
*Philadelphia City Pass. Ry.....	50	1,000,000	1475,000	\$7.50 share July '97	176 1/2	180	Boston, Mass.—Feb. 7:						
*Philadelphia & Gray's Ry. RR.....	50	1,000,000	298,650	\$3.50 share July '97	87	..	Fort Wayne Electric Co.....	25	.....	.....	.....	..	..
*Ridge Avenue Passenger Ry.....	50	750,000	1420,000	\$12 share, July '97	262	..	Ft. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	..	..
*Philadelphia & Darby Ry. guar.	50	.....	1200,000	\$2 share July, '97.	..	..	General Electric Co..... com.	100	40,000,000	80,460,000	2% Q. Aug., 1898.	88 1/2	89
*17th & 19th Sts. Pass. Ry. guar.	50	.....	1250,000	1 1/2% S. July, '97.	157 1/2	..	General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2% S. July, '98.	89	90
*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	1835,000	\$11 sh. A. July, '97	263	..	T. H. Elec. Co. T. Secur., Series D.	50	.....	146,700	.....	8 1/2	8 1/2
*Union Passenger Ry. Co.....	50	1,500,000	1900,000	\$9.50 share, July '97	225	226	Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	3,996,053	1 1/2% Q. Oct., '97.	54	55
*West Philadelphia Pass. Ry.....	50	750,000	1750,000	\$10 share, July '97	225	235	Westinghouse El. & Mfg. Co. pfd.	50	11,000,000	8,196,126	.....	..	..
Rochester, N. Y.—Feb. 7:							New York.—Feb. 7:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16 1/2	18	Edison Elec. Ill'g Co., New York...	100	10,000,000	7,938,000	.....	181	134
Reading, Pa.—Feb. 7:							*Edison Elec. Ill'g Co., Brooklyn...	100	4,000,000	8,750,000	1% Q. Oct., '97.	109 1/2	110 1/2
Reading Traction Co.....	100	1,000,000	1,000,000	Semi-an., Jan. & Jy	10	15	Edison Ore. Milling Co.....	100	.....	.....	.....	..	..
*City Passenger Ry.....	50	850,000	350,000	July, '97.	111	..	Edison Electric Storage Co.....	100	.....	.....	.....	..	..
*East Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	60	..	General Electric Co..... com.	100	40,000,000	30,460,000	2% Q. Aug., 1898.	86 1/2	86 1/2
St. Louis Mo.—Feb. 7:							General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2% S. July, '98.	88	90
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..	Interior Conduit & Insulation Co....	100	1,000,000	1,000,000	.....	41	..
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1888.	..	..	United Elec. Lt. & Pow. Co. pfd.	100	.....	.....	.....	..	..
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% July, '97.	124	126	Pittsburg, Pa.—Feb. 7:						
National Railway Co.....	100	2,500,000	2,479,000	1 1/2% July, '97.	..	..	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	..
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000	.....	..	..	East End Electric Light Co.....	50	800,000	800,000	Q.	..	10
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110	Philadelphia, Pa.—Feb. 7:						
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% July, '97.	95	105	Edison Electric Light Co.....	100	2,000,000	.....	144 1/2	..	..
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% July, '97.	170	172 1/2	*Electric Storage Battery Co. com.	100	8,500,000	.....	24 1/2	25	
People's RR. Co.....	50	1,000,000	300,000	50c., Dec., '89.	..	..	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	27 1/2	29	
Southern Electric Ry..... com.	50	500,000	500,000	.....	50	52 1/2	*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	21 1/2	21 1/2
Southern Electric Ry..... 6% pfd.	100	1,000,000	1,000,000	3% S. Jan., '96.	100	102 1/2	*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000	.....	6% Oct., '97.	55 1/2	55 1/2
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	49	51	Northern Elec. Light & Power Co....	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	18 1/2	14
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '96.	..	175	Southern Elec. Light & Power Co....	10	187,500	187,500	.....	10	..
San Francisco, Cal.—Feb.							Miscellaneous.—Feb. 7:						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	108	109	Brush Electric Co.....	50	.....	.....	.....	..	..
Geney Street Park & Ocean RR.....	100	1,000,000	375,000	\$2.50 share, '96.	40	50	Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	82 1/2	85	
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	53 1/2	..	Edison Ill'g Co. (St. Louis).....	25	.....	.....	.....	..	..
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	7	..	Eddy Electric Mfg. Co.....	25	.....	.....	.....	15	..
Seranton, Pa.—Feb. 7:							Hartford (Conn.) Elec. Light Co....	100	850,000	.....	118	125	
Seranton Railway Co.....	50	6,000,000	2,500,000	.....	9 1/2	11	Hartford (Conn.) Lt. & Power Co....	25	175,000	.....	4 1/2	10	
*Seranton & Carbondale Trac. Co..	100	500,000	500,000	.....	15	18	New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	148	..	
*Seranton & Pittston Traction Co..	100	1,050,000	1,050,000	.....	9	11	Narragansett (Prov., R. I.) Elec. Co.	50	1,200,000	.....	2% Q. Oct., '96.	82 1/2	85
Springfield Ill.—Feb. 7:							Rhode Island Elec. Protec. Co.....	100	.....	.....	114	118	
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11	Royal Elec. Co. (Montreal).....	100	1,000,000	.....	2% Q.	154 1/2	155
Springfield O.—Feb. 7:							Toronto (Canada) Elec. Light Co....	100	1,085,000	1,085,000	1 1/2% Q.	186 1/2	187 1/2
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2	Thomson-Houston Welding Co.....	100	.....	.....	3% S. Dec. 1, '96.	90	100
Springfield, Mass.—Feb. 7:							Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	..	..
Springfield Street Ry.....	100	1,200,000	1,000,000	8% A.	205	210	ALLIED INDUSTRIES.						
Toronto Canada.—Feb. 7:							Boston Mass.—Feb. 7:						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	98 1/2	99 1/2	American Electric Heating Co.....	50	10,000,000	.....	.....	..	..
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	248	250	Street Ry. & Ill'g Properties..... pfd.	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	80	85
Washington, D. C.—Feb. 7:							United Electric Securities Co. pfd.	100	.....	.....	2% Feb., '96.	..	..
Belt Ry. Co.....	50	500,000	500,000	.....	..	..	New York.—Feb. 7:						
Capital Traction Co.....	100	112,000,000	12,000,000	65c. per sh. Oct. '97.	70 1/2	70 1/2	Consolidated Electric Storage Co....	100	.....	.....	.....	..	..
Columbia Ry. Co.....	50	400,000	400,000	5% A.	68	70	Edison European.....	100	.....	.....	.....	..	..
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	..	..	Safety Car Heating & Lighting Co....	100	.....	.....	.....	88	94
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	..	..	Worthington Pump Co..... com.	100	5,500,000	5,500,000	.....	15	20
Metropolitan RR. Co.....	50	1,000,000	437,130	2 1/2% Q.	121	..	Worthington Pump Co..... pfd.	100	2,000,000	2,000,000	7% Q.	87	90
Worcester, Mass.—Feb. 7:							Philadelphia, Pa.—Feb. 7:						
*Worcester Traction Co..... com.	100	8,000,000	8,000,000	.....	15	17	Acetylene L. H. & P. Co..... \$35 pd.	50	1,000,000	.....	.....	5	..
*Worcester Traction Co..... pfd.	100	2,000,000	2,000,000	3% S. Sept., '97.	94	97	Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	74 1/2	..
Worcester & Suburban Street Ry....	100	550,000	542,500	4%, 1896.	85	..	United Gas Improvement Co. scrip.	50	10,000,000	.....	.....	15	16
Wilkesbarre, Pa.—Feb. 7:							Welsbach Commercial Co..... com.	100	8,500,000	.....	2% Q.	59	60
Wilkesbarre & Wyoming Val. Trac.	100												

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.							Amount.		Interest periods.		NAME.		Amount.		Interest periods.					
							Authorized.	Issued.	Due		Bid.	Asked.			Authorized.	Issued.	Due		Bid.	Asked.
Albany, N. Y.																				
Date of Quotation—Feb. 7, 1898.																				
The Albany Ry. Co. 1st mtg. 5s. \$500,000 \$29,000 1905 J. & J. 111 106 1/2																				
The Albany Ry. Co. Cons. mtg. 5s. 750,000 427,500 1930 M. & N. 111 106 1/2																				
The Albany Ry. Co. Gen. mtg. 5s. 850,000 875,000 1919 M. & N. 117 106 1/2																				
Waterfront Turnpike & RR. 1st mtg. 6s. 150,000 150,000 1919 M. & N. 115 106 1/2																				
Waterfront Turnpike & RR. 2d mtg. 6s. 150,000 150,000 1919 M. & N. 115 106 1/2																				
Troy City Railway Co. 1st mtg. 5s. 150,000 150,000 1919 M. & N. 115 106 1/2																				
Interest guar. by Albany Ry. Co.																				
Principal and interest guar. by Albany Ry. Co.																				
Baltimore Md.																				
Date of Quotation—Feb. 7, 1898.																				
Baltimore City Pass. Ry. 1st mtg. g. 5s. 2,000,000 2,000,000 1911 M. & N. 115 116																				
Baltimore Traction Co. 1st mtg. 5s. 1,500,000 1,500,000 1929 M. & N. 115 107																				
Baltimore Trac. Co. Exten. & Imp. g. 5s. 1,250,000 1,250,000 1901 M. & S. 108 107																				
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s. 1,750,000 1,750,000 1912 J. & D. 116 107																				
Central Pass. Ry. Co. 1st mtg. g. 5s. 96,000 117,000 1912 J. & J. 112 107																				
Central Pass. Ry. Co. Cons. mtg. g. 5s. 601,000 580,000 1932 M. & N. 112 107																				
City & Suburban Ry. 1st mtg. g. 5s. 8,000,000 8,000,000 1922 J. & D. 115 116																				
Lake Roland Elev. 1st mtg. 5s. 1,000,000 1,000,000 1942 M. & S. 111 111																				
Metropolitan Ry. (Wash.) 1st mtg. g. 5s. 1,850,000 1,850,000 1925 F. & A. 119 1/4 121																				
\$151,000 in escrow to retire 1st mtg. bds.																				
Boston, Mass.																				
Date of Quotation—Feb. 7, 1898.																				
Lynn & Boston RR. 1st mtg. g. 5s. 5,379,000 8,702,000 1924 J. & D. 101 1/2 102 1/2																				
West End Street Ry. Deben. g. 5s. 8,300,000 8,000,000 1902 M. & N. 105 107																				
West End Street Ry. Deben. g. 4 1/2s. 2,000,000 2,000,000 1914 M. & S. 107 107																				
\$11,074,000 in escrow to retire outstanding bonds of absorbed companies.																				
Charleston, S. C.																				
Date of Quotation—Feb. 7, 1898.																				
Enterprise Street RR. 1st mtg. 5s. 500,000 47,000 1906 J. & J. 101 101																				
Charleston City Ry. 1st mtg. 6s. 850,000 850,000 1911 J. & J. 101 101																				
Controlled by Charleston St. Ry. Co.																				
Chicago Ill.																				
Date of Quotation—Feb. 7, 1898.																				
Chicago City Ry. 1st mtg. 4 1/2s. 6,000,000 4,619,500 1901 J. & J. 102 1/2 102 1/2																				
Chicago Passenger Ry. 1st mtg. 6s. 400,000 400,000 1906 F. & A. 103 1/2 103 1/2																				
Chicago Passenger Ry. Cons. mtg. 6s. 1,000,000 600,000 1929 J. & D. 103 103																				
Chicago & So. Side R. T. 1st mtg. g. 5s. 7,500,000 7,500,000 1929 A. & O. 103 103																				
Chicago & So. Side R. T. 2d mtg. g. 5s. 1,500,000 750,000 1907 J. & J. 103 103																				
Chicago West Div. Ry. 1st mtg. 4 1/2s. 4,040,000 4,040,000 1932 J. & J. 103 103																				
Lake Street Elevated RR. 1st mtg. g. 5s. 7,574,000 3,781,200 1928 J. & J. 55 55																				
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s. 15,000,000 15,000,000 1942 F. & A. 51 1/2 52																				
North Chicago St. RR. 1st mtg. 5s. 8,171,000 8,171,000 1906 J. & J. 101 101 1/2																				
North Chicago St. RR. Cons. mtg. 5s. 500,000 500,000 1911 J. & J. 103 103 1/2																				
North Chicago City Ry. 1st mtg. 6s. 500,000 500,000 1900 J. & J. 102 1/2 102 1/2																				
North Chicago City Ry. Consol. 4 1/2s. 2,500,000 2,500,000 1927 M. & N. 102 1/2 105																				
West Chicago St. RR. 1st mtg. 5s. 4,100,000 8,969,000 1928 M. & N. 101 1/2 105																				
West Chicago St. RR. Cons. mtg. 5s. 2,700,000 700,000 1911 J. & D. 101 101 1/2																				
West Chicago St. RR. Cons. mtg. g. 5s. 12,500,000 6,000,000 1936 98 99																				
W. Chicago St. RR. Tunnel. 1st mtg. 5s. 1,500,000 1,500,000 1909 F. & A. 101 101 1/2																				
Redeemable at option on 60 da. notice.																				
Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.																				
Subject to call after Oct. 1, 1899, at \$110 and interest.																				
Assumed by W. Chi. RR. Co., lessee.																				
Int. guar. by W. Chicago St. RR. Co.																				
Cincinnati, O.																				
Date of Quotation—Feb. 7, 1898.																				
Cin. New & Cov. St. Ry. 1st Cons. mtg. g. 5s. 8,000,000 2,500,000 1922 J. & J. 99 1/2 100 1/2																				
Mt. Adams & Eden Pk In. 1st mtg. 6s. 46,000 46,000 1900 A. & O. 107 1/2 107 1/2																				
Mt. Adams & Eden Pk In. 2d mtg. 6s. 100,000 100,000 1905 A. & O. 111 111																				
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s. 531,000 531,000 1906 M. & S. 107 1/2 107 1/2																				
So. Cov. & Cin. St. Ry. 1st mtg. 6s. 250,000 250,000 1912 M. & S. 118 1/2 120 1/2																				
So. Cov. & Cin. St. Ry. 2d mtg. 6s. 400,000 400,000 1932 J. & J. 126 130																				
Assumed by the Cin. St. Ry. Co.																				
\$250,000 reserved to retire 1st mtg. bds.																				
Cleveland, O.																				
Date of Quotation—Feb. 7, 1898.																				
Brooklyn Street RR. Co. 1st mtg. 6s. 600,000 600,000 1903 M. & S. 105 106																				
Cin. New & Cov. St. Ry. Cons. mtg. 5s. 8,000,000 2,500,000 1922 J. & J. 99 1/2 100 1/2																				
Cleveland City Cable Ry. 1st mtg. 5s. 2,000,000 2,000,000 1909 J. & J. 100 103																				
Columbus (O.) Cent. Ry. 1st mtg. g. 5s. 3,500,000 1,249,000 1918 M. & S. 104 105																				
East Cleveland RR. 1st mtg. 5s. 1,500,000 1,500,000 1913 M. & N. 106 1/2 107 1/2																				
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s. 600,000 1,000,000 1910 M. & S. 106 1/2 107 1/2																				
Lorain (O.) Street Ry. 1st mtg. 6s. 200,000 200,000 1915 J. & J. 100 102																				
St. Ry. Co., Grand Rapids. 1st mtg. 5s. 600,000 600,000 1912 J. & D. 107 1/2 107 1/2																				
\$1,500,000 in escrow to retire bonds of absorbed companies, marked A.																				
Interest guar. by Cons. St. Ry. Co.																				
Detroit, Mich.																				
Date of Quotation—Feb. 7, 1898.																				
Detroit Citizens' St. Ry. 1st cons. 5s. 7,000,000 8,835,000 1905 A. & O. 95 95																				
Fl. Wayne & Belle Isle Ry. 1st mtg. 6s. 400,000 877,000 1902 A. & O. 98 1/2 98 1/2																				
The Detroit Ry. 1st mtg. 5s. 1,800,000 1,800,000 1925 J. & D. 97 1/2 97 1/2																				
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.																				
New Haven, Conn.																				
Date of Quotation—Feb. 7, 1898.																				
New Haven St. Ry. 1st mtg. g. 5s. 600,000 600,000 1911 M. & S. 102 1/2 102 1/2																				
New Haven (Edgewood Div.) 1st mtg. 5s. 250,000 250,000 1914 J. & D. 102 102																				
Waterbury Avenue RR. 1st mtg. g. 5s. 500,000 500,000 1911 M. & N. 102 1/2 102 1/2																				
Waterbury Avenue RR. Deben. g. 4s. 100,000 94,000 1901 M. & S. 102 102																				
Interest guar. by Cons. St. Ry. Co.																				
New Orleans La.																				
Date of Quotation—Jan. 31, 1898.																				
Canal & Claiborne RR. 1st mtg. 6s. \$150,000 \$150,000 1912 M. & N. 100 1/2 100 1/2																				
Creacent City RR. 1st mtg. 6s. 50,000 50,000 1899 M. & N. 100 1/2 100 1/2																				
Creacent City RR. Cons. mtg. g. 5s. 5,000,000 3,000,000 1943 J. & J. 78 1/2 80																				
New Orleans City RR. 1st mtg. 6s. 416,500 399,000 1903 J. & D. 106 109																				
N. Ori's City & Lake RR. 1st mtg. g. 5s. 5,000,000 2,599,500 1943 J. & J. 100 1/2 101 1/2																				
N. Orleans & Carrollton RR. 2d mtg. g. 6s. 350,000 350,000 1907 F. & A. 108 108																				
Orleans Railroad Co. Cons. mtg. 6s. 800,000 800,000 1912 J. & J. 91 1/2 99																				
St. Charles St. RR. Co. 1st mtg. 6s. 800,000 75,000 1906 J. & D. 103 1/2 103 1/2																				
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.																				
\$190,000 outstanding.																				
New York.																				
Date of Quotation—Feb. 7, 1898.																				
Atlantic Ave. (Brooklyn) Imp. g. 5s. 1,500,000 1,500,000 1934 J. & J. 85 90																				
Atlantic Ave. (Brooklyn) 1st gen. mtg. 5s. 750,000 750,000 1909 M. & S. 108 108																				
Atlantic Ave. (Brooklyn) Cons. mtg. 5s. 3,000,000 1,968,000 1931 A. & O. 105 106																				
Broadway & 7th Ave. 1st cons. mtg. g. 5s. 12,500,000 7,650,000 1943 J. & D. 122 123																				
Broadway & 7th Ave. 2d mtg. 5s. 1,500,000 1,500,000 1904 J. & D. 105 1/2 108																				
Broadway & 7th Ave. 3d mtg. 5s. 500,000 500,000 1914 J. & J. 111 112																				
Broadway Surface. 1st mtg. 5s. 1,125,000 1,125,000 1924 116 116																				
Broadway Surface. 2d mtg. 5s. 1,000,000 1,000,000 1905 105 107																				
Brooklyn City RR. Co. 1st cons. mtg. 5s. 6,000,000 6,000,000 1941 J. & J. 115 115																				
Brooklyn City & Newtown. 1st mtg. 5s. 2,000,000 2,000,000 1939 J. & J. 114 115																				
Brooklyn Bath & W. E. RR. Gen. mtg. 5s. 1,000,000 448,000 1933 J. & J. 85 90																				
Brooklyn Heights RR. 1st mtg. 5s. 250,000 250,000 1941 A. & O. 102 1/2 102 1/2																				
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s. 8,500,000 8,500,000 1941 J. & J. 106 1/2 108																				
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s. 4,500,000 2,750,000 1941 M. & N. 80 80																				
Brooklyn Rapid Transit. 1st gold 5s. 7,000,000 5,181,000 1945 91 1/2 91 1/2																				
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s. 700,000 700,000 1900 105 108																				
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s. 1,200,000 1,200,000 1902 J. & D. 113 115																				
Central Crostown RR. 1st mtg. 6s. 250,000 250,000 1922 M. & N. 118 122																				
Coney Island & Brooklyn RR. 1st mtg. 5s. 800,000 800,000 1903 J. & J. 104 105																				
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s. 1,000,000 980,000 1932 J. & D. 115 117																				
Dry Dock, E. Bd'y & Bat'y R. scrip 5 1/2s. 1,100,000 1,100,000 1914 F. & A. 97 101																				
Eighth Av. RR. Co. Cert. indebt. 6 1/2s. 1,000,000 1,000,000 1914 F. & A. 100 100																				
42d St. Man. & St. Nich. Av. 1st mtg. 6s. 1,200,000 1,200,000 1910 M. & S. 116 118																				
42d St. Man. & St. N. Av. 2d mtg. Inc. 6s. 1,500,000 1,500,000 1915 J. & J. 95 95																				
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s. 5,000,000 5,000,000 1938 M. & S. 121 121																				
Metropolitan St. Ry. Co. m. cl. tr. g. 5s. 12,500,000 1,500,000 1907 F. & A. 114 1/2 114 1/2																				
Second Avenue Ry. Gen. cons. mtg. 5s. 1,600,000 1,600,000 1909 M. & N. 108 110																				
Second Avenue Ry. Cons. mtg. 5s. 300,000 300,000 1909 J. & J. 101 105																				
Steinway Ry. (L. I.) 1st mtg. g. 6s. 1,500,000 1,500,000 1922 J. & J. 112 115																				
South Ferry RR. Co. 1st mtg. 5s. 350,000 350,000 1919 102 107																				
Third Avenue RR. 1st mtg. g. 5s. 5,000,000 5,000,000 1937 J. & J. 123 1/2 125																				
Twenty-third Street Ry. 1st mtg. 6s. 150,000 150,000 1909 J. & J. 103 108																				
Twenty-third Street Ry. 2d mtg. 6s. 150,000 150,000 1906 J. & J. 103 108																				
Union (Huckleberry) Ry. 1st mtg. 5s. 2,000,000 2,000,000 1912 F. & A. 101 1/2 106																				
Westchester Electric RR. 1st mtg. 5s. 500,000 500,000 1943 J. & J. 103 105																				
\$1,035,000 in escrow to retire gen. mtg. bonds.																				
\$14,850,000 in escrow to retire maturing obligations.																				
\$552,000 in escrow to retire 1st and 2d mtg. bonds.																				
In treasury, \$80,000.																				
Guar. by Union Ry. Co.																				
Toronto Canada.																				
Date of Quotation—Feb. 7, 1898.																				
Montreal St. Ry. 1st mtg. 5s. 2,500,000 300,000 1908 M. & S. 101 101																				
Toronto St. Ry. 1st mtg. g. 4 1/2s. 4,550,000 2,200,000 1921 M. & S. 101 101																				
\$35,000 per m. single track authorized.																				
\$600,000 in escrow to retire 6s due in 1901.																				
Philadelphia.																				
Date of Quotation—Feb. 7, 1898.																				
Continental Pass. Ry. 1st mtg. 6s. 350,000 310,000 1909 J. & J. 101 101																				
Empire Pass. Ry. 1st mtg. 7s. 300,000 200,000 1900 J. & J. 101 101																				
Greene & Coates St. Ry. 1st mtg. 6s. 100,000 100,000 1898 J. & J. 101 101																				
Lombard & So. St. Pass. Ry. 1st mtg. 6s. 150,000 150,000 1901 101 101																				
People's Pass. Ry. 1st mtg. 7s. 250,000 250,000 1905 J. & J. 101 101																				
People's Pass. Ry. 2d mtg. 5s. 500,000 458,000 1911 J. & J. 101 101																				
People's Pass. Ry. Cons. mtg. 5s. 1,125,000 867,000 1912 M. & S. 101 101																				
People's Pass. Ry. Stk. trs. cert. g. 4s. 5,698,210 5,698,210 1913 99 1/2 99 1/2																				
Phila. City Passenger Ry. 1st mtg. 5s. 200,000 200,000 1910 J. & J. 101 101																				
Philadelphia Trac. Co. Coll. tr. g. 4s. 1,300,000 1,018,000 1917 F. & A. 104 105																				
Thirteenth & 15th St. Ry. 1st mtg. 7s. 100,000 100,000 1903 A. & O. 101 101																				
Union Passenger Ry. 1st mtg. 5s. 500,000 500,000 1911 A. & O. 101 101																				
Union Traction Co. Coll. tr. 4s. 29,735,000 29,724,876 1945 A. & O. 101 101																				
West End Passenger Ry. 1st mtg. 7s. 250,000 250,000 1905 101 101																				
West Phila. Pass. Ry. 1st mtg. g. 6s. 250,000 246,000 1906 A. & O. 115 1/2 115 1/2																				
West Phila. Pass. Ry. 2d mtg. 6s. 750,000 750,000 1926 M. & N. 114 1/2 115																				
The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.																				
Pittsburg, Pa.																				
Date of Quotation—Feb. 7, 1898.																				
Birmingham, Knox & Allentown. 6s. 500,000 500,000 1931 M. & S. 101 101																				
Central Traction Co. 1st mtg. 5s. 875,000 375,000 1930 J. & J. 115 115																				
Citizens' Traction Co. 1st mtg. 5s. 1,250,000 1,250,000 1927 A. & O. 110 110																				
Duquesne Traction Co. 1st mtg. 5s. 1,500,000 1,500,000 1930 J. & J. 110 110																				
Fed'l St. & Pleasant Valley. Cons. 5s. 50,000 50,000 1913 J. & J. 101 101																				
Fed'l St. & Pleasant Valley. Cons. 5s. 1,250,000 1,250,000 1912 J. & J. 101 1/2 101 1/2																				
Millvale, Etna & Sharpsburg. 5s. 750,000 750,000 1923 M. & N. 106 1/2 106 1/2																				
Pittsburg, Crafton & Mansfield. 5s. 250,000 250,000 1924 J. & J. 105 105																				
Pittsburg Traction Co. 1st mtg. 5s. 750,000 750,000 1927 A. & O. 104 104																				
Pittsburg & Birmingham. 1st mtg. 5s. 1,500,000 1,500,000 1922 M. & N. 104 105																				
Pittsburg & West End. 1st mtg. 5s. 500,000 500,000 1922 J. & J. 104 104																				
Pgh. Allegh. & Manch. Gen. mtg. 5s. 1,500,000 1,489,000 1930 A. & O. 114 114																				
Second Ave. Traction Co. 1st mtg. 5s. 2,500,000 2,000,000 1934 J. & D. 101 101																				
Sub. Rapid Transit Railway Co. 6s. 500,000 500,000 1913 M. & S. 101 101																				
Providence R. I.																				
Date of Quotation—Feb. 7, 1898.																				
Newport Street Ry. Coupon 5s. 50,000 50,000 1910 J. & D. 101 101																				
United Trac. & Elec. Co. 1st mtg. g. 5s. 9																				

PASSENGER RAILWAY.

NOTES FOR INVESTORS.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Feb. 7, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1903	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co.....1st mtg. 5s.	1,000,000	700,000	1916	M. & S.	105	108
Mount City RR. Co.....1st mtg. 6s.	400,000	300,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	300,000	300,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	111	112
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Feb., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	107	....
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126	....
†Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	....
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	....	101½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	....
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	115	118
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Feb. 7, 1898.						
Belt Ry. Co. ....C.....mtg 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....C.....mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home.....mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Feb. 7, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	94	97
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	....
Crosstown St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	94½	97½
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	.....	101
Denver Con. Tram'g Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	.....	95
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	112	112½
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	91
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	116	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	*90	....
St. Paul City Ry.....Cons. g. 6s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$500,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of C. St. RR. Co.						
†\$47,000 in treasury.						
†\$960,000 reserved to redeem prior liens.						
††\$620,000 in escrow.						
*With interest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
<i>Date of Quotation—Feb. 7, 1898</i>						
Edison Elec. Illuminating Co., Boston	2,026,000	.....	1922	Quar.	154	....
General Electric Co. gold coup. deb. 5s.	10,000,000	8,750,000	1922	....	100½	....
Pittsburg, Pa.						
<i>Date of Quotation—Feb. 7, 1898.</i>						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1913	A. & O.	....	....
Westinghouse Elec. & Mfg. Co. Serp. 6s.	195,570	.....	....	M. & S.	....	....
Miscellaneous.—(Feb. 7, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	....	111	....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,116,000	1933	....	113	....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 5s.	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 5s.	2,000,000	....	....	....	103	....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	....	1909	A. & O.	....	....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	....	1921	Q'ry.	....	....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 5s.	5,000,000	....	....	....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
<i>Date of Quotation—Feb. 7, 1898</i>						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 7s.	.....	.....	....	....	108	....
N. Y. & N. J. Telep. & Tel. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	103½	....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	....	....	....	....

ALLIED INDUSTRIES.

Miscellaneous.						
<i>Date of Quotation—Feb. 7, 1898</i>						
American Electric Heating Co. 5s.	500,000	500,000	....	....	15	19
Armington & Sims Eng. Co. 5s.	.....	.....	....	....	25	....
*Barney & Smith Car Co. 1st mtg. 6s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	....	....
Washington Pump Co. 5s.	75,000	.....	....	....	....	....
*Unlisted †Nominal.						

Late quotations for copper are: Electrolytic, 10½¢@10½¢; Lake, 10½¢@11¢; cast, 10½¢@11¢.

The West Chicago Street Railway Company has declared a quarterly dividend of 1½ per cent., payable February 15.

A new tariff went into effect in Tasmania on January 1, and under its provisions electric light cables and insulators are subject to a duty of 10 per centum ad valorem.

The Philadelphia "Times" states that in 1897 the Electric Storage Battery Company of that city earned enough to pay three years' accrued interest on the preferred stock.

It is reported on good authority that the Baltimore Consolidated Traction for the first six months of its fiscal year, July 1 to December 31, increased its net earnings more than \$100,000.

The National Abrasive Manufacturing Company, capital \$1,000,000, has been incorporated at Trenton, N. J., to purchase land in North Carolina particularly valuable for deposits of corundum.

A receiver has been appointed for the Michigan City Street Railway, which is owned by Russell Harrison, son of ex-President Harrison. The liabilities are estimated at \$40,000. What the assets are is not stated.

The New York "News Bureau" says it is currently reported that there will be some sort of a stock dividend made to the stockholders of the Edison Electric Illuminating Company at the annual meeting to be held in a few days.

Contracts are being prepared by the superintendent of the Third Avenue Railroad Company, New York, for changing the motive power on the company's "Boulevard" line and likewise for changing the Fort Lee Ferry and Fort George lines from cable to electricity.

The Boston "Post" in a strong editorial on telephone reform suggests that the regulation of the telephone business in Massachusetts be placed in the hands of the Gas and Electric Light Commissioners. The "Post" demands lower rates. A telephone reform bill has been drawn up to be presented to the Legislature.

At the annual meeting of the Edison Electric Illuminating Company of Boston, held on the 1st inst., the board of directors were re-elected, as follows: Walter C. Baylies, Henry B. Cabot, T. Jefferson Coolidge, Jr., C. H. Custer, George Dexter, C. D. Edgar, W. Powell Mason, John C. Rogers and George S. Silsbee.

The stockholders of the Kinloch Telephone Company, St. Louis, have adopted a resolution in favor of issuing \$1,000,000 in bonds. In speaking of the bonds General Manager H. J. Hunford said that they had all been subscribed for some time by the directors and stockholders of the company, but that they had not decided when the new bonds would be issued, as they had not yet been printed or engraved.

A motion was made before Judge Simonton at Charleston, S. C., last week requesting that the order allowing the Western Union Telegraph Company until the April rules to file their replication to the answer of the Railroad Commission as to the telegraph rates in that State be rescinded or the time lessened. The motion was denied, therefore the company has until the April rules to file its replication.

Ex-Congressman John Kean has offered the Freeholders of Union County, N. J., \$100,000 for a trolley road franchise between Elizabeth and Plainfield. Mr. Kean stipulates that the money shall be used in widening the avenue on which the tracks are to be laid. A committee consisting of Freeholders Littell, Ogden, King, Wahl and Swain was appointed to confer with Mr. Kean in reference to details. The offer is the first of its kind ever made in New Jersey.

The stockholders of the Erie Canal Traction Company, which is said to have the exclusive right to equip the canals of New York State with electricity, held their annual meeting last week. Directors elected were: L. A. von Hoffmann, W. G. Oakman, R. S. Hayes, G. G. Haven, T. C. Pratt, F. W. Hawley, A. S. Heidelberg, Commodore P. Velder and C. T. Lewis. At a subsequent meeting the following officers were elected: L. A. von Hoffmann, president; F. W. Hawley, vice president; C. T. Lewis, secretary.

Judge Gottfried Krueger, the millionaire Newark brewer and trolley magnate, has announced the cessation of hostilities between the New York & Philadelphia Traction Company and the Brunswick Traction Company. This clears away the only great obstacle for the New York & Philadelphia line by way of Somerville and Bound Brook and work on this line will be rapidly pushed to completion. Another line is to run from New York to Easton. In this connection it is reported that a trolley combination is on the verge of completion which proposes to connect Philadelphia and New York by a direct trolley line. The new company is to be known as the Union Traction Company of New Jersey and is to be capitalized at between \$50,000,000 and \$100,000,000.

The Mexican Government has published an order to the Mexican National Railroad Company and the Mexican Central Railroad Company, notifying them that they must discontinue handling commercial and other telegraph messages between the United States and Mexico. According to the order the railroads may use their telegraphs "solely to serve in safeguarding the running of trains." The effect of the order, if fully carried out, means that the telegraph service in Mexico must be carried over the Federal lines. Under a contract between the Government and the Mexican Telegraph Company, operating by cable from Galveston to Vera Cruz, with the Western Union from Laredo and El Paso, all international telegrams must under the order be carried by those companies. The Postal Telegraph Company, which has been using the railroad lines for some time, holds that the order is unconstitutional and will not be sustained by the Mexican courts.

Attorney General Grey of New Jersey has begun suit in the Supreme Court of that State against the Electro Pneumatic Company, whose principal office in the State is in Camden. The suit is started in the nature of an information. The company owes \$1,700 for taxes and its charter was recently forfeited by proclamation by the Governor for the non payment of this tax. The State understands that the company is still doing business, and the object of the suit is to force the payment of the back tax or to compel the company to desist from attempting to operate under its charter. The matter will come up for hearing February 14. Some time since the company was transferring its stock to the Manhattan Trust Company of New York, but the further doing of this was enjoined by Chancellor McGill. W. W. Allen of Philadelphia is president of the company.

The National Conduit Cable Company of New York has brought suit in the Circuit Court of Baltimore against the Eastern Electric Company, David M. Newbold and James W. McEnoy, receivers, and the United States Trust Company, to have declared void a mortgage made by the Eastern Electric Company to the United States Trust Company on July 15, 1897, for the purpose of securing an issue of bonds to the value of \$50,000. The New York Company alleges that the bonds were never sold, and the Eastern Electric Company never received any return for them; that the entire issue was placed in the hands of William J. Atkinson, at that time an employee of the company, and that he took bonds outside of the State of Maryland. It is said that it cannot now be ascertained where he is, but that the interest on the bonds is about to fall due, and that it will be demanded of the receivers. It is alleged that the mortgage is void, and its payment would be a fraud on the creditors. The court is asked to enjoin the receivers from paying any interest on the bonds and to enjoin the holders from collecting either interest or principal.

ELECTRICITY.

Vol. XIV.

NEW YORK, FEBRUARY 16, 1898.

No. 6.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUMS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	81-82
A Startling Theory as to Electricity.	
Wind as a Motive Power.	
The New Trolley Systems and Snow.	
Under the Searchlight,	82
The Calculations of the Electrical Resistances of Alloys and Their Application to the Finding of Alloys of Definite Electrical Properties. By C. Liebenow,	83
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XIV.—Ozone. By J. B. C. Kershaw, F. I. C.,	85
The Patent Office Behind in Its Work.	86
Topics of Interest to Central Station Men. By Lieut. Francis A. Badt,	86
Tests on the Englewood and Chicago Electric Storage Battery Road,	87
Magnetic Wind,	88
Smallest Electric Motor,	88
Patent Amendments,	88
A Special Prize Offer,	88
Partial List of Exhibitors at the Electrical Exhibition,	89
New York Electrical Society,	89
Personal,	89
Drawbacks—The Kind to Get,	89
Legal Notes,	89
General News,	90
Personal and Miscellaneous.	
Recent Company Elections,	91
Commercial Paragraphs,	91
Incorporations,	91
Electrical Patent Record,	92
Telephone and Telegraph,	92
Electrical Securities—Stocks, Bonds, Etc.,	93
Notes for Investors,	96

EDITORIAL NOTES.

A Startling Theory as to Electricity.

Dr. William M. Gross of Gillespie, Ill., claims that he has invented an electrical machine which in his opinion will revolutionize the methods of producing electric power. In a recent issue of the St. Louis *Post-Dispatch* he is credited with making the following statement regarding his theory:

"My purpose is to capture and utilize the earth-seeking electricity. I am in opposition to the schools in believing that electrical force is induced and not static. I do not pretend to be an electrician. Time will tell whether I am a scientist."

It will be seen from the above paragraph that Dr. Gross holds that electricity is an induced and not a static force as is generally believed. With a view to proving his theory correct, he has carried on from time to time experiments in St. Louis by means of kites, with questionable success. Among other things, Dr. Gross asserts that the earth and its atmosphere go to make up an immense armature, with that portion of space between the earth and the sun as the electromagnet. His opinion is that the earth in revolving generates a powerful current, and he reasons this out as follows:

"The sun is shining on one-half of the earth all the time. Its rays are vertical on some portion of the earth all the time. The space between the earth and the sun is heavily charged with electricity. Currents of this electricity are induced out of space by the revolution of the earth from west to east. In accordance with the rule of electric currents, they pass in the opposite direction, going from east to west. This is in obedience to the law, interpreted by Lenz more than sixty years ago, that induced currents of electricity always go in opposite directions to the electro-magnetic force producing the current. These currents are brought down to and through the earth by the latter's centrifugal force. This force tends from the center and toward the east. The currents tend from the east and to the center of the earth. When the center becomes surcharged the current flows off at about the 70th parallel, producing the north and south winds."

The details of Dr. Gross' machine have been kept secret, but his idea is to develop an apparatus that will have proportionally greater centrifugal force than that of the earth. As the earth travels 17 miles a minute, his machine is designed to go even faster, in order to induce the electricity that he is striving to obtain.

According to Dr. Gross' statement, he has not only developed to his own satisfaction a new theory as to electricity, but also offers a new and startling explanation as to the cause of the winds. His theory is said to have originated from a discovery he made several years ago, while experimenting with the

ground wire of a telephone, that the earth was apparently full of electricity. Possibly the line on which he was experimenting was affected by some of the stray currents from the trolley railways that have been causing so much trouble with the telephone system lately in St. Louis. This would seem a reasonable explanation in view of the fact that up to the present the experiments he has conducted with his new apparatus have proven more or less unsatisfactory. Further experiments are shortly to be made, however, in St. Louis, which should either prove Dr. Gross' theory absurd or revolutionize our present doctrine and methods.

* * *

Wind as a Motive Power.

Considerable has been written of late of the great possibilities that lie in the wind-mill or modern aermotor for generating electric current economically. A few of the sensational dailies have pointed out from time to time how every high office building in New York could, by erecting suitable aermotors on the roof, obtain enough electric power by an arrangement of storage batteries to not only light the building but run the elevators as well. These papers have even endeavored to show by figures that there is in the neighborhood of 500,000 horse power going to waste every ten hours in Greater New York which could be had, practically without cost, for the taking. As far as figures go, almost any horse power could be named in this respect as going to waste without fear of contradiction. What amount of power the wind blowing over Greater New York represents in ten hours is an unknown quantity and cannot be figured out even approximately.

There is no doubt but what there is a large amount of power in the wind, which if properly utilized could be made to do an enormous amount of work. The Saracens and Egyptians were well aware of this fact, and utilized wind power for grinding corn and performing other species of work. As is well known, even in this country at the present day an improved form of windmill is extensively used, principally for pumping water.

Probably the latest invention of this nature is that of Victor L. Ochoa, who has developed an aermotor by means of which he proposes to turn wind into electricity. His device differs from the ordinary circular form in that it consists of four arms with a solid shutter-like arrangement on each. The shutters swing on hinges. While the wind is driving two of the shutters, it lifts the other two, so that they offer the minimum of resistance to the wind.

A local paper referring to the transformation of wind into electricity says:

"This conversion of energy, while it sounds like a startling proposition, is not such an extraordinary matter after all. Mr. Ochoa simply turns the power

of a windmill into electrical force. He accomplishes that much by the most simple process imaginable—that of attaching a dynamo to a windmill.

"There's nothing extraordinary in that, except that no one seems to have thought of doing it before."

The writer of the above paragraph would seem to assume that the running of a dynamo by means of a windmill is something that has never been attempted. If we mistake not Dr. Fridtjof Nansen in his last attempt to reach the North Pole had the Fram equipped with a specially designed windmill which when operating drove a dynamo and furnished the necessary current for lighting purposes. An aermotor erected on the roof of a building in Park Place in this city has been for some time successfully driving a dynamo in connection with a storage battery plant, the current from which has been utilized for incandescent lighting. From this it will be seen that there is nothing very new in the application of windmills to the driving of dynamos. There are probably several reasons why the windmill or aermotor has not been more universally adopted for the above purpose. In the first place, such a motive power is always more or less uncertain and cannot always be depended upon. There may be a calm just at the time it is found necessary to recharge the batteries, or the batteries may be in use when a breeze springs up. This would necessitate having two sets of batteries at a considerable cost. Another reason why aermotors have not been more extensively adopted is probably due to the fact that current can now be generated with steam as a motive power very economically, especially in large quantities. The erecting of an aermotor and the installation of a number of storage batteries with a dynamo means a considerable outlay of money, especially when the cost of maintenance and renewals is taken into account. In certain cases it may be found that the interest on the batteries, generator and windmill, with the labor item figured in, will cost as much in the long run as the current could be purchased for on the outside. But probably the chief reason why the power of the wind is allowed to go to waste when it could be employed for generating electricity is the same as that which prevents the use of the immense power derivable from the tides in both the Hudson and East rivers from being utilized, namely conservatism, or if not, lack of progress, a slowness in availing ourselves of opportunities.

* * *

The New Trolley Systems and Snow.

There would seem to be a general movement on foot among the street railway companies, more especially in the Borough of Manhattan, to substitute the electric conduit system for the cable that is now in use. The Third Avenue Railroad Company has now apparently caught the fever which its rival, the Metropolitan Street Railway Company, has had for some time, and proposes to equip its lines at no distant date with electricity. Among the lines to be at once equipped with the electric conduit system are the Forty-second Street, St. Nicholas Avenue and Manhattanville Railroad and the Dry Dock road. New lines are to be built on Washington Heights, jointly by the rival companies, which will connect with the Forty-second Street line and will be operated by the underground trolley. To enable cars to be run continuously from Forty-second street to Washington Heights it was found necessary to adopt a uniform motive power. The Third Avenue Company has therefore built a large electric power station near the Kingsbridge road.

Officials of the Third Avenue road are quoted as stating that statistics they have received in regard to the operation of the underground trolley in large cities have convinced them that electricity is not only much cheaper than horses, but also less expensive than the cable. Furthermore, the underground trolley has shown its adaptability to heavy traffic, and it apparently makes no difference whether cars run on one minute headway or five minutes apart.

There is little doubt but what in the long run electricity as a motive power is more economical than horses, but whether it is less expensive than the cable is rather questionable. In the first place, the copper in the conductors and feeders would cost more than the wire cables now in use. As far as the conduit is concerned it would cost as much or more to build than the cable conduit, for far greater precautions would have to be taken in its construction to ensure proper drainage and in insulating the conductor. The power station would have to be equipped not only with engines aggregating the same total horse power as now in use, but further with dynamos of practically the same capacity as the engines. Moreover, every car on the line would have to be equipped with motors, which would be another item of expense. On the other hand there is practically nothing to offset the increase of interest on the greater amount of capital invested. There is little or no saving in fuel, and consequently little saving in power.

With the conduit trolley system there is always the chance of a short circuit occurring, as happened recently on the new Madison Avenue line during a snow storm. The company stated that the trouble was due to the burning out of a plough. This may very possibly have been the case, but it is rather strange that this should have occurred during the first heavy snow storm that has visited the city this winter. Whether the trouble was due to the current passing from one side to the other of the plough, or whether it was due to the fact that the ground was covered with snow makes little difference—the short circuit occurred and disarranged the traffic for some time. We are curious to see what the next heavy snow storm will develop.

Col. N. H. Heft, the chief electrical engineer of the New York, New Haven & Hartford road, is said to have been well pleased with the behavior of the third rail system during this same snow storm. The New York Sun refers to the matter as follows:

"When morning came to-day every track was buried deeply in snow. Steam locomotives were sent out with the snow ploughs to clear the line between here and New Britain, and as soon as the tops of the rails were uncovered the electric current was turned on and trains were started at 9 o'clock. These trains have run all day, keeping close to their half-hourly schedule without difficulty, and the electrical engineers report that although all the rails were surrounded with snow there was no loss of current.

"On the Berlin branch, running from Berlin to New Britain, there were no snow ploughs sent out, but two or three trains were pushed over the line by steam locomotives, so as to uncover the rails, and then the electric cars were put to work and continued their trips all day."

The rather striking feature of the above account would seem to be the fact that if it had not been for the steam locomotives it would have been impossible to operate the road. And yet this severe test, as it is called, has been hailed by the General Electric Company and the officials of the road as proving beyond a doubt the capability of the third-rail system coping successfully with any kind of weather. According to this it will be seen that every third-rail system operating in the open will have to be equipped with a number of steam locomotives to clear the track of snow and keep it clear during the inclement season. We are obliged, of course, to accept the company's statement as to there not having been any loss of current when the conducting rail was surrounded with snow.

We do not wish to be misunderstood and have our readers infer that we are in any way opposed to electricity as a motive power where it can be utilized to advantage, but, as we have several times stated in our editorial columns, electricity has frequently been adopted by companies to supersede some other form of power, not on the score of economy, but for various exploitation purposes, or often as an excuse for watering the stock of a corporation.

Under the Searchlight.

Notes and Comments on Various Topics.

THE following taken from the New York Morning Telegraph describes one of the General Electric's methods of getting orders and quieting recalcitrant persons:

Ralph Beach, of General Electric, will go down to history as the greatest living exponent of the art of "jolly" known to the century. Few men can hold high-salaried positions because natural financial ability is supplemented by an infinite fund of tact in smoothing the wrinkles out of ill-tempered foreheads. Mr. Beach is the good fairy of General Electric. When everything is drifting in a direction that seems to threaten a wreck of worlds and crush of matter Mr. Beach is called upon to use his magic wand. He has never been known to fail in straightening out a tangle between the company and an exacting customer or to send away mollified the man who comes to the Edison Building bent on "cleaning out that nest of thieves." Mr. Beach has one trick, but he plays it for a big success every time. When a man says "d—n General Electric," Mr. Beach, instead of getting warm himself, says: "You're dead right, old man. To h—l with General Electric. The whole combination is as bad as leaky boots. The less you have to do with them the better." This is so different to what the angry man expects from a member of the executive force of the company that he is startled. Then it flatters him to feel that the other man so thoroughly agrees with him. He came braced up for a fight, but Mr. Beach's soft answer leaves him defenceless. Then comes the invitation to lunch, with wine and cigars, and later the executive force of General Electric chortles with glee as it listens to Mr. Beach's story and counts the profit on the additional order he has taken from the man who came to kill them all.

It is now universally conceded that many a true word is spoken in jest.

* * *

THERE are times when the Western Electrician is on the right side in General Electric news, but the following from their issue of February 5 is evidently a blunder or a joke:

The General Electric plant at Schenectady, N. Y., it is reported, is running day and night to keep up with the large amount of work on hand. The company's new fiscal year was begun February 1, with contracts aggregating \$21,000,000 and cash in the treasury of \$2,500,000, it is said.

The Western Electrician should have learned by this time through the columns of ELECTRICITY that the business done by the General Electric Company in the past two years has hardly amounted to \$24,000,000. Our Western contemporary evidently got this news item from a floating paragraph in one of the financial papers intimating that the G. E. Company had new business on hand at the commencement of the present fiscal year amounting to \$4,000,000. There is a wide difference between that figure and \$24,000,000—but what's the difference!

* * *

IT is stated that Marshalltown, Ia., is experimenting with a street-car motor that is expected to drive the trolley out of existence, or the enthusiastic papers of that city are much mistaken. It uses a combination of gasoline and storage batteries, is noiseless, is said to get there with all four of its wheels, and is in every way satisfactory as far as it has gone. It is in an experimental stage so far, and is having an average of two breakdowns a week, but the defects are being remedied, and then it is going to astonish the world, so the unsophisticated inhabitants of Marshalltown think.

* * *

MR. J. M. HILLS, who so ably represents the Bryan-Marsh Company in Chicago, has been in New York several days as the special envoy of the Northwestern Electrical Association to secure the co-operation of the Eastern central station men, manufacturers and dealers in the proposed trip of the Northwestern Association on the lakes immediately following the Convention of the National Electric Light Association in Chicago in June next. It is the intention to occupy four or five days on this trip, a fine steamer being chartered for the purpose. It will be obvious to every one who contemplates attending the June Convention that this will afford an excel-

lent opportunity to enjoy a healthful and delightful pleasure trip and cultivate social acquaintance with many persons worth knowing.

* * *

FOR weeks past the Alabama and Georgia telephone line passing through Mountainsboro has been cut by unknown parties, wires beat in two by rocks, and poles torn up. The matter was turned over to Deputy Sheriff Noel and he has been watching the line at different points. On a recent night Joe Chavies and Cisero Bruster, two young men, came up within a few feet of where the deputy sheriff was standing and soon had the pole down and the wire in two. They were arrested and carried to jail at Gadsden next morning. Some one asked them what they meant by such work; they replied, "Meanness, I reckon."

* * *

We gather from a Spanish paper that tenders for a direct cable from Spain to Cuba will most likely be advertised for this month. We trust that this proposed new connection between Spain and Cuba will be the means of more accurate war news being transmitted to the mother country and will be more successful than the other recent attempts at a conciliation or annihilation of the Cubans.

THE CALCULATIONS OF THE ELECTRICAL RESISTANCES OF ALLOYS AND THEIR APPLICATION TO THE FINDING OF ALLOYS OF DEFINITE ELECTRICAL PROPERTIES.*

BY C. LIEBENOW.

(Continued from page 69.)

The resistance of alloys made out of metals of the class A can therefore be very easily computed as the reciprocal value of the sum of the conductivities of the constituents.

$$R = \frac{1}{\frac{n}{r_1} + \frac{1-n}{r_2}}$$

In this equation r_1 and r_2 designate the resistances of the components of which n and $1-n$ parts respectively are contained in the alloy (n and $1-n$ expressed in parts of volume, the total volume taken as = 1).

For other alloys a second member has to be added on account of the thermo-electric force. The total expression is a very comprehensible form, viz.:

$$R = \frac{1}{\frac{n}{r_1} + \frac{1-n}{r_2}} \times \frac{1}{\frac{a_1}{n} + \frac{a_2}{1-n}}$$

which can be easily remembered. The equation contains four constant quantities: r_1 and r_2 are the resistances of the pure metals of which n and $1-n$, parts of volume, are alloys; a_1 and a_2 are two more constants which must be computed from the resistances of two alloys. If this has been done, the equation will give us a resistance of every alloy of any proportion.

If the fraction is reduced, the equation becomes one of the third degree with respect to n . If we therefore mark the resistances R as ordinates on cross-section paper, n the abscissas, we obtain a curve of the third degree, which has a maximum within the range to be considered.

I have tested the agreement of this curve with actual observations taken from a known series of experiments, and wish to demonstrate some of the same to you. This curve, Fig. 28, represents the gold-silver alloys. You will see that the curve rises rapidly in the beginning and continues to rise slowly and more slowly but finally falls down in a rapid

way. This shows that just a small percentage of one metal alloyed to another one causes a large change in the resistance. The resistance of silver increases with the addition of 1 per cent. of gold about 20

the first test of my theory the series of alloys of two rare metals, viz., the silver-gold alloys, as for this the conditions for absolute purity could be best fulfilled. You see here in Fig. 28 the result. The

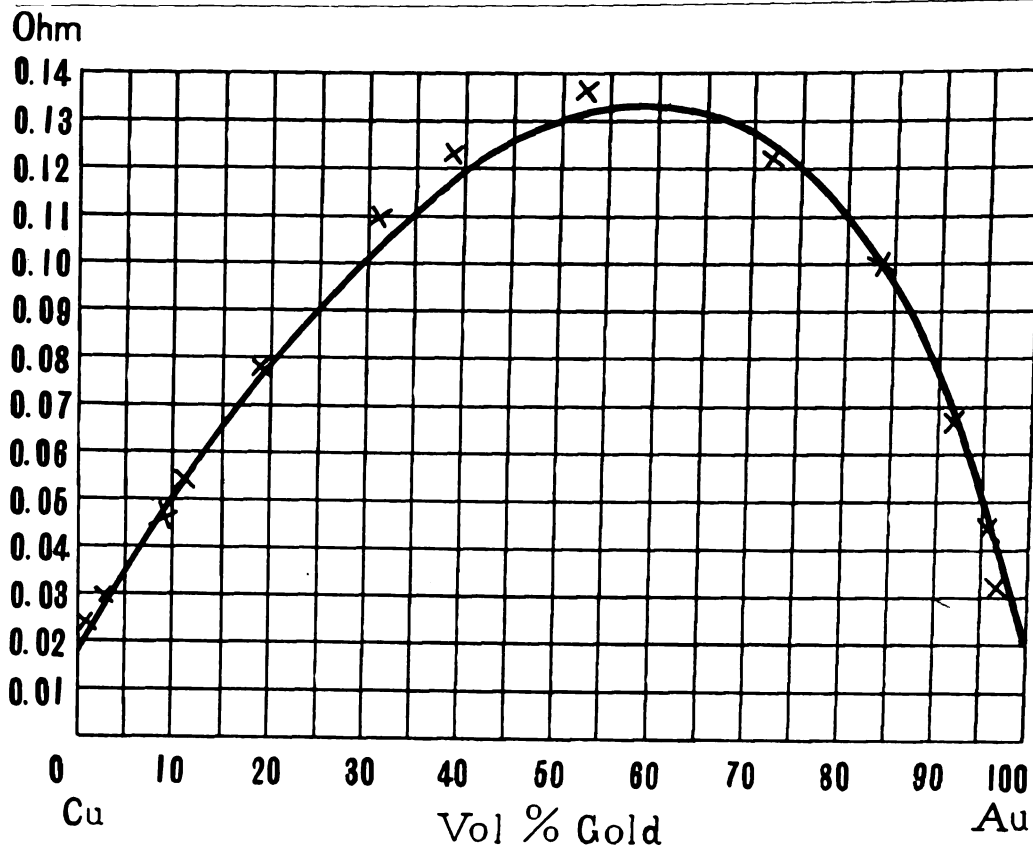


FIG. 28.

per cent., and in the same way the resistance of gold increases by the addition of 1 per cent. silver 16 per cent., notwithstanding silver is a much better conductor than gold. Small percentages of carbon,

measurements applied were made forty years ago by Matthiessen and Holzmann. These scientists determined the conductivity of eighteen gold-silver alloys at ordinary temperature, which was in every

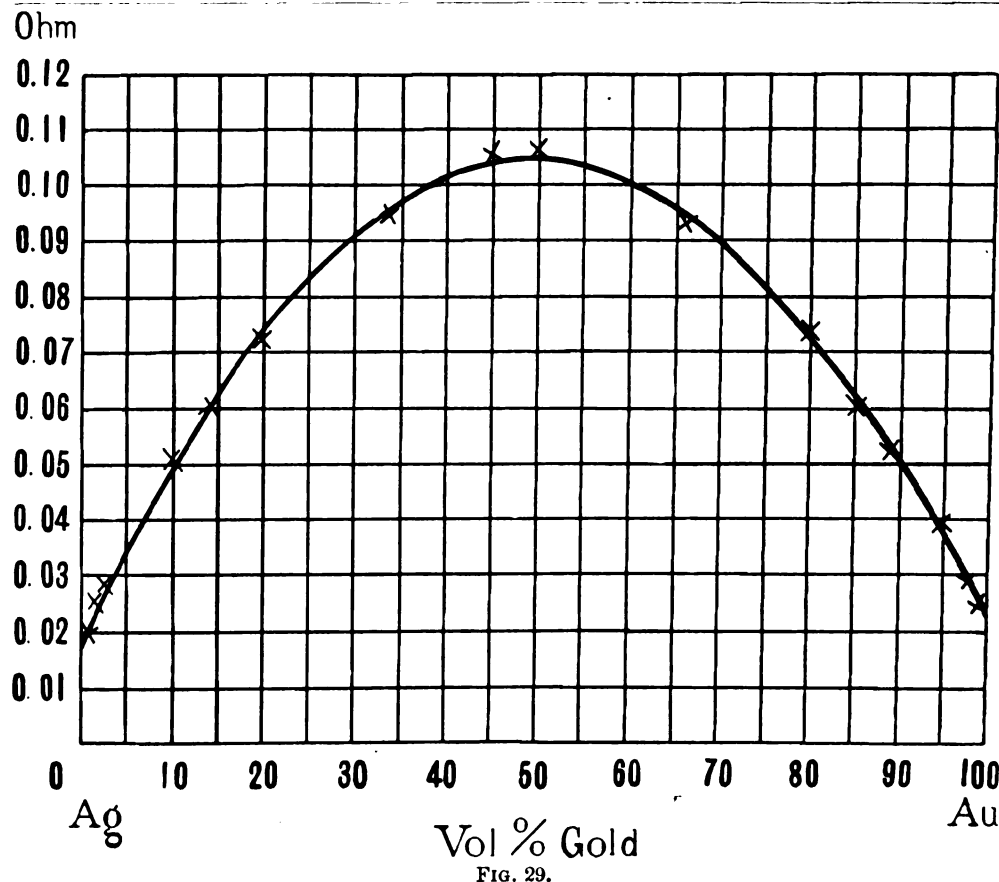


FIG. 29.

phosphorus or any oxide has still a much more marked influence upon the resistances of metals. You can apprehend from this how important exact measurements are if you desire to have the metals exceedingly pure. On account of this I selected for

case carefully noted. They used the conductivity of pure silver at zero degree centigrade as unit.

I reduced the data to ohms at 0° C. and marked them as crosses in the cross-section paper, using the resistances as ordinates and the volume per cent. of

*Paper read before the Elektrotechnischen Verein on Nov. 23, 1897. (Translated for ELECTRICITY.)

gold as abscissas. From this data of measurements I have computed the constants a_1 and a_2 , as 2.70 and 3.09, whereas the specific resistance of gold is .021326 and of silver .015623; the formula for the gold-silver alloy is therefore, if we express n not in parts of the total but in per cent., as follows:

$$R_0 = \frac{1}{\frac{\% \text{ gold}}{2.1436} \times \frac{\% \text{ silver}}{1.5623}} \times \frac{1}{\frac{270}{\% \text{ gold}} \times \frac{309}{\% \text{ silver}}}$$

Out of this formula I have computed the resistances for alloys varying from 5 to 5 per cent. in gold. These values I have connected by a curve as shown in Fig. 28. I must confess that the agreement between the observed and computed values has widely surpassed my expectations. The observed data are falling almost without exception within the line of curve.

The observations therefore have verified the correctness of the formula.

In Fig. 29 you will see the series for the gold-copper alloys. The agreement is not quite as good, but as cast copper very easily becomes porous, slight de-

times it disappears entirely, and sometimes it becomes even negative.

We will probably make no mistake in assuming that all four constants of our equation will be in some way influenced by temperature. For the two first ones, viz., τ_1 and τ_2 , as already mentioned, the above named coefficient holds good. For the other two constants in the second member of the equation the influence of temperature is however very small, indeed so small that I have succeeded as yet in finding it for copper only. In all other cases it is not noticeable, and in general can be neglected.

If, for the sake of simplicity, we designate the first fraction in the above equation as A and the second fraction as B , we will get for the approximate value

$$R(1 + \gamma t) = A(1 + \alpha t) + B.$$

Here γ designates the temperature coefficient of the alloy and $\alpha = 0.004$. If we solve this equation with respect to γ we get

$$\gamma = \frac{A}{R} \alpha$$

According to this formula the temperature co-

metals undergoes when two of them are alloyed stand in close agreement with our other experiences, without having to resort to the assumption of metal compounds.

We will now turn our attention for a short time to the other changed physical properties, and we will consider how other substances behave if mixed. We will pour together two liquids which will mix with each other in any proportion. We will take 50 liters of water and 50 liters of alcohol, pour them together in a 100 liter vessel and stir the mixture well. The result will be that we will not have 100 liters of mixture but only 97 liters. Now what is the cause of this contraction? Modern physics teaches that liquids are nothing else than compressed gases which stand under a very high internal pressure acting normally to their surfaces. This pressure is the result of forces acting between the single molecules. We could designate it as a pressure of cohesion. In the interior of the liquid this pressure is acting upon the molecules uniformly from all sides, but on the surface it is one-sided, acting towards the interior. It is as if the uppermost skin of the liquid compresses the body of the liquid. And this pressure amounts to about 2,400 atmospheres for alcohol at 0° C. and to about 10,700 atmospheres for water. When we mix alcohol with water, then not only do alcohol molecules come in contact with alcohol molecules, and water molecules with water molecules, but alcohol molecules come also with water molecules in counter action, and the total pressure of cohesion changes its value. If we had separated in a cylinder the 50 liters of water and the 50 liters of alcohol by a loose membrane, so that one liquid was above the other, and we wished to compress the 100 liters to 97 liters by the aid of a hydraulic press, it would certainly require a pressure higher than 1,000 atmospheres.

Such an increase of the pressure on the surface must be accounted for by the interaction of the molecules of water and alcohol in the mixture. This increase, which the molecules are causing apparently with such little effort, has nevertheless the same effect on the liquid as we could accomplish only by means of sufficient hydraulic pressure. Similar changes in the pressure of cohesion may be expected when we mix two molten metals together.

But also in the solid state there must be forces acting of similar magnitude; and there may be in many alloys a much higher pressure acting normally to their surfaces than are acting in their constituents.

It is well known to you that ice, for example, will melt at a lower temperature than the normal temperature 0° C. if under the influence of higher pressure, and in general the melting point changes with the pressure. If we consider this fact, the changes in melting points of alloys do not seem to be exceptional. The same consideration explains their changed specific weight, their high tensile strength and the high luster often found in alloys. The metals in alloys often behave, not only as if they were hammered together with heavy steam hammers, but the increased pressure of cohesion remains permanently. It may be well to mention, however, that this pressure may occasionally become smaller after the alloying of the metals than the mean of the constituents would indicate. The assumption of new metallic compounds with absolutely new properties seems therefore entirely superfluous so far as all cases yet mentioned are concerned.

Does it not seem probable, therefore, that chemical compounds of two metals do not exist?

(To be continued.)

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

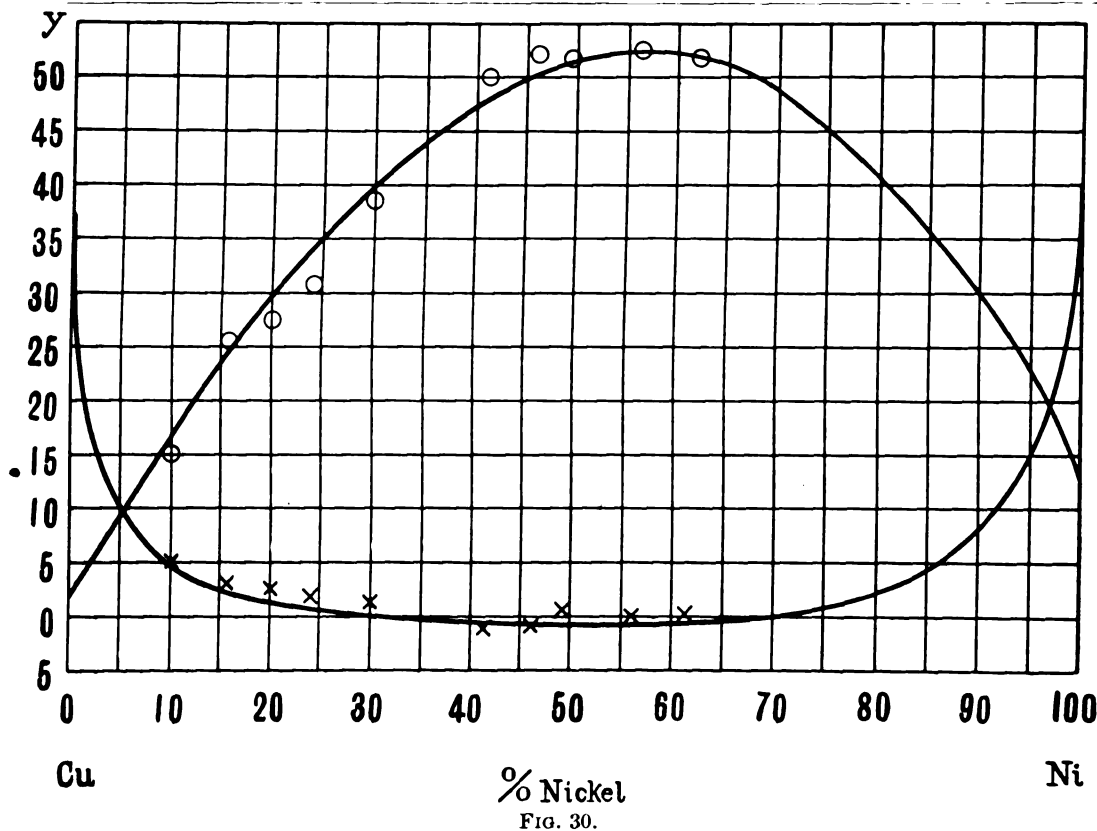


FIG. 30.

viations must be expected. The curve is computed from the formula:

$$R_0 = \frac{1}{\frac{\% \text{ gold}}{2.1436} \times \frac{\% \text{ copper}}{1.677}} \times \frac{1}{\frac{390}{\% \text{ gold}} \times \frac{195}{\% \text{ copper}}}$$

The constants of the second member I have rounded off, leaving it for the future to correct them still further. It is remarkable, that the constant for gold is exactly twice as large as the one for copper. In other cases I have found mostly simple ratios. This however seems to be incidental only to silver and gold, for which the best series of observations are at hand.

If we give our attention to a factor which plays a very important part in the resistance of metals, viz., the temperature coefficient of resistance, we find that this coefficient is much more influenced by the alloying of metals, as already mentioned, than the resistance itself. Temperature variations, as is well known, have a very marked influence on the resistance of pure metals. The average coefficient is about 0.004, which means that if the resistance of a metal at 0° C. equals 1, this resistance will be at a temperature t ° C., about equal to $1 + .004t$.

If, however, we alloy two metals, the temperature coefficient becomes in most cases very small—some-

efficient of most of the alloys can be very closely computed. I have found as yet that only alloys containing copper show a noticeable discrepancy, and the reason for this is due to the fact that copper changes its internal molecular conductivity for heat considerably with change in temperature. If this conductivity at 0° C. equals 1, it is at t ° C. equal to $1 + .0006t$.

This coefficient I have determined from a series of observations made by Feussner upon copper-nickel alloys. The alloys were made by the firm of Basse & Selve, of Altena, Westphalia. They contained, however, according to Dr. Feussner's analysis, impurities of iron, manganese, zinc, etc., in sufficient quantities as not to be negligible for our purpose. The agreement between calculation and observation, Fig. 30, is nevertheless satisfactory, and it shows that a negative temperature coefficient of such alloys is explainable by our theory. The formula for the copper-nickel alloys is the following:

$$R_0(1 + \gamma t) = \frac{1 + 0.004t}{\frac{\% \text{ Ni}}{1.3} + \frac{\% \text{ Cu}}{1.82}} + \frac{1}{\frac{62}{\% \text{ Ni}} + \frac{41.3(1 + 0.0006t)}{\% \text{ Cu}}}$$

We see, therefore, that the herein shown remarkable changes which the electrical resistance of

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XIV.—Ozone.

The production of ozone upon an industrial scale by means of the silent discharge of alternating currents of electricity at high potential, has been attracting during recent years considerable attention from electricians and chemists in Europe. Though up to the present date the instances in which ozone, or ozonized air, is being produced and applied to industrial purposes upon a business basis are few, yet one or two such commercial installations exist. The possibilities of advance both as regards the more economical production of ozone by the electrostatic method and the widening of its field of application are also hopeful, and therefore some account of the process and apparatus used to produce the ozone, and of its applications both actual and suggested may rightly be considered to be within the scope of these chapters.

Ozone production is not yet an industry; but it is one of those newer branches of electro-chemical progress which may show startling developments in future years; and the record of past progress and present achievement is certainly worthy of the attention of readers of *ELECTRICITY*.

Chemical Properties.—Ozone is a gas and is a condensed form of oxygen, three atoms of oxygen being contained within the molecule of ozone, as opposed to the two atoms which form the molecule of ordinary oxygen. The chemist is accustomed to picture the molecules of oxygen and of ozone to himself by the following graphic formulae, in which the circles represent atoms of oxygen, and the straight lines the chemical bonds or affinities:



The extremely active oxidizing and disinfecting properties of ozone are due to the ease with which it gives up its third atom of oxygen and reverts to the ordinary molecule of oxygen containing only 2 atoms. This liberated single atom of oxygen is in what chemists describe as the nascent condition, and in this state it can effect chemical changes impossible to the ordinary molecule of oxygen.

In calculating the oxidizing or bleaching effects that may be expected from the action of a given quantity of ozone, it is necessary to remember that only one-third of its oxygen is effective.† The ozonized air produced by the forms of apparatus described in these chapters rarely contains more than 5 per cent. ozone, and it therefore follows that the effective oxygen it contains seldom exceeds 1.7 per cent. This very dilute mixture of ozone with ordinary air is however a very efficient bleaching and sterilizing agent. The presence of ozone in air is generally revealed by a sharp, pungent odor not unlike that of air containing a small percentage of chlorine. If a piece of filter paper moistened with a solution of starch containing potassium iodide be brought into ozonized air, a gradually deepening purple stain is produced upon it due to the liberation of the iodine and to the formation of purple iodide of starch. This is the most simple and most delicate test for the detection of ozone in air.

There are three different methods by which oxygen can be converted into ozone. If a stick of phosphorus be left in a closed bottle half filled with water for several days, ozone will be found in the enclosed air. This is the chemical method. If a solution of sulphuric acid in water be electrolyzed with platinum or gold electrodes, ozone will be found at the surface of the anode. This is the electrolytic method. If electricity at high potential be dis-

charged through air, ozone will again be produced. This is the electrostatic method. Whenever a frictional electrical machine is worked, small quantities of ozone are produced, and their presence may be easily detected by one's nose. Although ozone can be produced by the three methods described above, the industrial production of ozone has only been attempted by the latter method. One of the first forms of ozonizer based upon use of the silent electrostatic discharge was that designed by Werner von Siemens in the year 1857‡, and all later forms are merely modifications of this earliest apparatus.

Siemens' ozonizer consisted of two concentric glass tubes. The inner tube was provided with an inner covering of tin-foil, while the outer was provided with an outside covering of the same. The tin-foil coatings were connected to the opposite poles of a source of high tension electricity, and air was passed through the annular space between the two glass tubes. Although a very large number of modifications of this original ozonizer have been patented, only four of these need claim special attention.

The Andreoli Ozonizer.—This ozonizer consists of alternate parallel surfaces of metal and of a dielectric. The metal electrodes are long narrow boxes, and water or some other cooling fluid is circulated through them in order to keep down the temperature, heating being one of the chief obstacles to good work in all forms of ozonizer.‡ The metal surfaces are covered with points to facilitate discharge of the electricity, there being 46 rows of points to the square foot. Andreoli states that an ozonizer possessing 12 metal electrodes would possess 53,760 points. These hollow point-bearing electrodes act on both surfaces, and are connected alternately to the poles of the high-tension transformer. This form of ozonizer, in which only one dielectric surface separates the metal electrodes, and in which the ozonized air is therefore in direct contact with the metal, is called by Andreoli an "open ozonizer," in contradistinction to those forms possessing two dielectric surfaces, which he calls "closed ozonizers." The oxidation of the metal is stated to be slight, and the gain in efficiency that results from dispensing with one dielectric surface between each pair of electrodes is stated to be considerable. This "open ozonizer" has yielded 35 grams ozone per E.H.P. hour in continuous work, while for short periods a yield of 48 grams has been obtained. Alternating currents of 10,000 volts have been used in the experimental work. Andreoli states that the maintenance of a low temperature and the quick withdrawal of the ozonized air from the apparatus are the chief conditions of good work. Further details of this apparatus, and of Andreoli's views upon the theory of the silent electrostatic discharge, will be found in the article named below.‡ Mr. Edward Beanes, who experimented in this field some years ago, has recently been controverting Andreoli's assertion that points increase the efficiency of the ozonizer. He asserts that the direct opposite is true, and states that even the air ought to be filtered through cotton-wool before entering the ozonizer in order to remove particles of dust which might otherwise settle on the metal plates and act as points. Those who wish to follow the discussion that is now being carried on between these two disputants are referred to the papers mentioned below.‡

The Andreoli open ozonizer has been at work for a considerable period at the works of Messrs. Allen & Hanbury, manufacturing chemists, London; the ozonized air produced here was used chiefly for bleaching and thickening oils. The patents are now owned by a small syndicate, who are seeking to extend the commercial applications of ozone and ozonized air.

‡ *Popp. Ann. Phys. Chem.*, 1857.

† Ozone is a very unstable form of oxygen, and mere heating is sufficient to cause its reversion to the ordinary form.

‡ "Ozone, Its Commercial Production and Applications," E. Andreoli. *Jour. Soc. Chem. Ind.*, February, 1897.

‡ *Jour. Soc. Chem. Ind.*, Vol. XVI, p. 393. *Electrical Review* (London), December, 1897.

The Tindal and Van der Steen Ozonizer.—This form of ozonizer has been at work for a considerable period in Paris, in connection with experiments upon the sterilization of Seine water. The results obtained in the first series of experiments were sufficiently promising to lead to the renewal of the concession from the Paris municipality for another three months.

The writer has not been able to obtain from Baron Tindal any details of the form of ozonizer used at Paris, or of the actual output of ozone per E.H.P. hour, although he applied some months ago for information. The water is sterilized by passing through towers containing perforated plates or coke, in which it meets with the ozonized air. The ozone produced by 1 E.H.P. hour is stated to be sufficient to sterilize 5,000 liters of water. This method of water purification is also receiving trial in Calcutta, a plant valued at \$24,000 having been prepared and sent out by the British Electro-Ozone Corporation of London in the summer of 1897.

The Yarnold Ozonizer.—A third form of ozonizer that has received trial upon a scale approximating to those of actual industrial operations is that patented by Yarnold and protected by British patents Nos. 2,488 of 1894 and 24,289 of 1895.

The form described in the first patent consists of a box filled with glass plates, the alternate ones coated on one side with gold leaf. These latter are connected to the poles of the transformer, alternate plates being connected to the positive and negative poles. Oxygen, or air, is passed through the spaces between the plates when the apparatus is at work.

With this form of ozonizer the inventor recommended alternating currents of 125 frequency and 50 volts; in his later patent he recommends 12,000 volts. The experimental plant now at work is stated to be yielding 1,800 to 2,000 cubic feet of ozonized air per hour, but the percentage of ozone in this air is not given.

The cost of a plant capable of producing 10,000 cubic feet of ozonized air per hour is given as \$6,240, and the cost of running it with electrical energy at 8 cents per kilowatt hour is estimated to be under 1 cent per 1,000 cubic feet of ozonized air produced. The experiments conducted with this form of ozonizer during the continuous run trial of nine months to which it has been subjected, have related to the use of the ozonized air for sweetening foul beer-casks, the drying and thickening of linseed oil, the seasoning of linoleum, and the production of hydrogen peroxide.

The Siemens & Halske Ozonizer.—This form of ozonizer has been at work since the year 1894 at a bleaching works at Greiffenberg in Germany, where the ozonized air is used in conjunction with a weak solution of hypochlorites for bleaching purposes. It is a curious fact that the bleaching of linen fabrics or cotton goods cannot be effected by the use of ozone alone, but that when chlorine and ozone are used alternately most excellent bleaching results are obtained.

The Siemens & Halske form of ozonizer consists of a metal inner tube enclosed in a larger glass tube, covered on its outer side with tin-foil. Since there is only one dielectric surface between the two metal surfaces, it is what Andreoli would term an open ozonizer. Water is circulated through the inner tube, and air or oxygen through the space between the two tubes. A number of these single ozonizers are combined to form a "tube-trellis." Dr. Fröhlich reports that this ozonizer produces 20 grams ozone per E.H.P. hour, a quantity sufficient to bleach 50 kgs. linen yarn or 40 kgs. potato starch. This ozonizer is used at Kyritz for the latter purpose, and is understood to be giving satisfactory results.

Other Applications.—Purposes for which ozonized air has been used, in addition to those mentioned above, are the ageing of wood for the manufacture of musical instruments, the ageing of whiskey, and the manufacture of artificial perfumes.

At one time it was hoped that a very wide field of usefulness would result from the applications of

† Dr. Thorne states that under certain conditions the whole of the oxygen enters into reaction. *Jour. Soc. Chem. Ind.*, Vol. XVI, p. 94.

ozonized air in the sugar industry, but the experiments carried out a few years ago have not justified these hopes. The great activity of ozone as a bleaching or oxidizing agent, while in some cases it favors its use, is in other cases the very property that prevents its employment. In the case both of sugars and of spirits or wines, the constituents are all oxidizable chemical compounds, and there is great danger that when these bodies are brought into contact with ozone or ozonized air other compounds than the impurities or coloring matters will be oxidized and converted into useless compounds. The slow methods of oxidation hitherto used in these industries have therefore one very decided advantage on their side, and on account of this absence of any danger of over-oxidation the writer doubts whether methods based upon the use of ozone will ever displace them. But there are many other fields of application in which there are no such limitations, and in these the question of the adoption of ozonized air as a bleaching or disinfecting agent is simply a question of cost. Of these the sterilization of drinking water is undoubtedly one of the most important, while the sweetening of sour beer-casks is another field in which considerable developments might be expected.

The Future.—It is evident that if ozonized air can be produced sufficiently cheaply there are numberless directions in which it can be advantageously employed. The progress of this industry in the future therefore depends chiefly upon the advances made in improving the yield, and the durability, of ozonizers. Otto† in a recent paper has stated that the potential and dielectrics used in the usual forms of ozonizer are not those which give the best results. In the form designed by himself he states that he has obtained an output of 150 grams ozone per EHP. hour by using a lower potential and alternating currents with a periodicity of 80 per second. The theoretical yield is stated to be 1,000 grams ozone per EHP. hour, and the efficiency of Otto's ozonizer is thus 15 per cent., as compared with 2 per cent. of Siemens & Halske's ozonizer, or the 3.5 per cent. obtained in the open ozonizer of Andreoli. The differences of opinion that exist between Beanes and Andreoli, and between Otto and all previous inventors, upon fundamental principles of the construction or working of ozonizers, would seem to indicate that inventors have not yet exhausted the possibilities of economical ozone production. The experiments that are now being carried on in many quarters will therefore no doubt lead to an improvement in the yield of ozone per EHP. hour, and consequently to a decided reduction in the cost of ozonized air per 1,000 cubic feet.

The Patent Office Behind in Its Work.

We learn from a Washington contributor that a deplorable condition of affairs exists in the United States Patent Office, due to the smallness of the working force, and the situation is becoming more serious every day. The examiners are from three to four months behind in their work, and some divisions of the office are as much as six months behind. There are on hand in round numbers awaiting action 13,000 cases, of which 9,600 have never been looked at, and it is probable that in the next four months the business will largely increase. March, April, May and June have heretofore been the heaviest months of the year, and there is no reason to doubt that the record will be kept up. The officials estimate that in that time 14,000 new cases will be received.

The applicants for patents are protesting against this delay. They claim they are entitled to prompt and efficient service. The Government requires them to pay for the work in advance, and then they are obliged to wait for months before having their applications attended to. One thing is certain, the efficiency of the Patent Office demands, in the interest of its clients, a suitable force of employees to prosecute the work intrusted to it.

† Mem. et Compt. Rend. des travaux de la Soc. des Ing. Civils de France; March, 1897; p. 310.

TOPICS OF INTEREST TO CENTRAL STATION MEN.*

BY LIEUT. FRANCIS A. BADT.

Mr. Chairman and gentlemen: When I got to Milwaukee yesterday I found to my surprise my name on the programme, stating that I would deliver an address on the subject of "Topics of Interest to Central Station Men." Now as a matter of fact I had simply asked for the privilege of saying a few words extemporaneously, to get acquainted with all of you, as this is my first appearance before this august body.

I read about twenty years ago, I believe, that a good extemporaneous speech should fulfil about twenty-four conditions. Now I have forgotten twenty-three of them, but I remember one, and that is that a good extemporaneous speech should not last over fifteen minutes, and in that respect you will note the difference between my short address and that of my friend Dow, who unfortunately is not here this morning. I would like to get back at him concerning a few remarks he made yesterday.

Mr. Dow brought up one subject, and that is the old, old subject of alternating currents vs. direct currents. My friend George Cutter and I discussed that fifteen or sixteen years ago at the old Chicago Electric Club, and the subject has been brought up time and again, and I think now that it is the universal opinion of engineers and such managers of central stations as have had an experience in both lines that where the conditions are favorable to the direct-current system it has great advantages in some respects over the alternating system, but that, however, in certain cases an alternating system must be installed, as a direct-current system will not reach the distances.

For the last four years I have been one of the many advocates of the straight 220-volt direct-current system, and when we commenced about four years ago to get lamp manufacturers to make us 220-volt lamps, they all declared it could not be done, the thing was not practicable, it would not pay them, and they wanted to know how many lamps we could order, and one thing and another; and in short we had almost to coerce them into making us 220-volt lamps, and I find to-day—and I feel very good over it—looking over the electrical papers, that a good many manufacturers advertise 220-volt lamps as a specialty. In other words, it has become a commercial article.

The advantages of the straight current 220-volt system are many. You all know that the Edison three-wire patent which was mentioned by Mr. Dow expires, if my memory does not fail me, in the spring of 1901; and it was one of the main reasons of getting a straight 220-volt system to avoid infringing on the Edison three-wire patent. Of course a straight 220-volt system is really simpler than the Edison three-wire system, necessitating only one dynamo, doing away with neutral wire, with balancing devices to keep the two sides of the three-wire system at proper voltages, etc. Now, setting aside the patent question entirely, a 220-volt system is much more easily managed than a three-wire system. It costs less to install it; it costs less to maintain it, if proper caution is used. We have to-day, as I stated before, 220-volt incandescent lamps, and within the last few months an arc lamp has been developed, not by one company but by a number of companies, an enclosed arc lamp of course, which will burn singly across 220 volts. You all know that a 220-volt direct-current motor has many advantages over a 120-volt motor, so that we may say that in the 220-volt direct-current system we have a good system for small central stations where moderate distances are to be met, say three-fourths of a mile radius from the station. The 220-volt arc lamp is probably known to many of you. It is a lamp which at nominal 2,000 candle-

power uses two and one-half amperes and consumes about 160 volts in the arc. The arc is three-fourths of an inch long. Of course the advantage of such a lamp overrunning two or three lamps in series is evident. You can supply a customer with one lamp without making that lamp depend upon somebody else's lamp, doing away with all series connections. You have a lamp which practically casts no shadow. Take an arc three quarters of an inch long and it does entirely away with shadows cast from the carbon tips. In short, I think that such a combination of 220-volt lamps, 220-volt arcs and 220-volt motors presents a very simple system and a system which I think, properly operated, will likewise earn money.

For isolated plants the 220-volt system will of course only be used where there is a good deal of motor service. Now take the elevator service which Mr. Dow mentioned as probably the severest service that can be had, the 220-volt arc has again the great advantage that great fluctuations in the power circuit will not be noticeable in the arc. You take an arc of 160-volt difference of potential, an arc three-quarters of an inch long, and it will practically not be affected by a variation in the power circuit of, say, 50 volts. Now there again is an advantage even in an Edison three-wire system of the 220-volt arc against two 100-volt arcs. In the Edison three-wire system of course the fluctuations on each side will be greater than the fluctuations of electromotive force on the outside wires. The balancing requires some attention, and often it happens that one side has more electromotive force than the other. Now if the electromotive force of the outside wire is kept fairly steady, you get of course less variations there than on either side, and a 220-volt arc will give better satisfaction.

The enclosed arc lamp itself has made great strides during the last few months towards perfection. Our friends on the other side of the water have declared time and again, and have proven it to us mathematically, that the enclosed arc is no good; that the open arc is of greater efficiency and has many advantages over the enclosed arc; but in spite of these theoretical demonstrations the enclosed arc is the arc to-day in the United States, and the open arc for constant potential circuits is getting out of vogue entirely. It is a back number, and gives us one of the illustrations where theory and practice do not coincide. The American is, if anything, practical, and if the great public here decides that the enclosed arc is the thing they want, it is the thing they must have, in spite of theory and efficiency or anything else. I think that it will not be very long when we will have an enclosed arc of 500 volts to be attached directly across the wires of a railway circuit. Now, there again such an arc will have great advantages over the old method of running from five to ten lamps in series, one lamp depending on the other, making the mechanism more complicated on account of outouts, extra resistance, etc.; and again, an arc of say 450 volts difference of potential will stand great fluctuations. Now the fluctuations in the railway circuit may be 100 volts or more, and while an arc of 450 volts will stand that, lamps five or ten in series will be seriously affected by such fluctuations. I think the solution of the question of a good practical lamp—never mind the efficiency—for railway circuits will be found in the enclosed arc lamp burning across 500 volts.

There is another little matter that I should like to mention in connection with the enclosed arc lamp, and that is the gas cap, as it is usually called—that is to say, the cover for the inside cylinder through which the upper carbon passes. That gas cap has got to have an opening of course through which the carbon passes. Now most of the enclosed arc lamps use what is commercially called a half-inch carbon. I have calipered a few hundred of them and find that they vary from 25-1000 of an inch below to 25-1000 of an inch above the standard half inch. You can easily see that one of the require-

* Address before the Northwestern Electrical Association, Milwaukee, Wis., January 19, 1898.

ments of an enclosed arc lamp is to have the carbon fit as tightly through the hole as possible, to prevent the outside air from getting into the cylinder. Now if the carbon is a little too large it will stick; again, if the carbon is too small, too much air will follow into the opening and the lamp won't last the guaranteed lifetime, 150 or 170 hours, whatever it may be.

Now I have also found that the different manufacturers of enclosed arc lamps—I think there are about twenty in the United States now—have not adopted the same diameter for the opening of the gas cap. The diameters vary from exactly half an inch to about 18-1000 of an inch above half an inch. Now taking that in connection with the variations in the diameters of carbons and you can see that a man who has a few hundred enclosed arc lamps, or less, and buys carbons indiscriminately without ascertaining the diameter, may have considerable trouble; and I would suggest that this Association take up the subject of standardizing the diameter of the hole in the gas cap and urge the manufacturers of enclosed arc lamps to adopt one standard. If that is adopted, then of course the carbon manufacturers could be compelled to furnish carbon within certain limits.

Of course it is impossible to have all carbons absolutely of the same diameter, because there is more or less shrinkage in the baking, but we could get so near to that standard that all the troubles as they exist now would be avoided. All this refers to the direct-current system of course.

Now, as to the alternating system, my opinion is that the single-phase system will eventually be the system. It recommends itself for its simplicity, and I think it will not be long now before we have any number of different makes of single-phase motors in the market. We have now, of course, incandescent lamps burning on alternating currents; we have alternating arc lamps; we have finally gotten a few alternating enclosed arc lamps that are good and give a light of about 100 hours with one dipping of 12 inch carbon; and if we get the single-phase motor I think we will have the system for stations that cannot avail themselves of the advantages of the direct-current system—in other words, where conditions are such that you have to cover large areas and have to use high tension primaries and low tension secondaries.

Mr. Dow mentioned one objection to alternating systems, namely that each customer had to have a transformer for the maximum capacity of the dwelling or whatever it might be, and he cited that as a great disadvantage of the alternating system as against the direct-current system. Now, I think that a good deal of that could be avoided in the alternating system by using larger transformers for a number of customers. Of course you could not do it economically with 50-volt lamps; you might not be able to do it economically with 110-volt lamps; but why not use 220-volt lamps? There again, I think, is a new field for the 220-volt lamp. Use large transformers, take one transformer, if possible, for a block, and then wire the block on the 220-volt system and use 220-volt translating devices, so that you get efficiency out of your transformer, and that will avoid the necessity of using a large number of small transformers, which of course means a good deal of money invested, low efficiency, etc.

Before I close I should like to draw your attention to something that is not exactly electrical, but in which we are all interested, and that is the heat engine. You probably are aware of the fact that the best type of modern stationary steam engine only yields us power equivalent to say about 13 per cent. of the energy which we find in good steam coal—in other words, there is 87 per cent. left for improvement. Compare that, for instance, with the dynamo where manufacturers guarantee 95 and 96 per cent. efficiency, and you see that we have not got very far as far as efficiency goes in steam engines for a century. Now the steam engine of the future will have

a much higher efficiency, of course. It will do away entirely with boilers. It will be a steam engine that burns the fuel—no explosions, but burns the fuel, either powdered coal dust or oil, in the engine. I am not guessing here, but I am just describing an engine which is now on exhibition on the other side of the water, and I know that a number of American capitalists are over there now trying to buy the patents. That will be the steam engine of the future. It will be an engine without boilers, gentlemen, and no explosions as in the gas engine, but burning fuel in the engine and utilizing it for power. Now you can all figure out for yourselves what a revolution in steam engineering such an engine would produce, and it looks ridiculous to me when I see in papers in Chicago statements made by one of our great street railway magnates there that his franchises will last forever, no matter what the city government may do, that they will last just as long as the present power is any good. Just as soon as we can do away with tracks in the streets and employ modern means of locomotion his franchise won't be worth a nickel. The American city of the future, as it appears before me, is a city without street-car tracks, with streets well paved with asphaltum or something similar, and motor cycles and motor buses passing in all directions on those pavements, and I think that the new engine will help us to realize this ideal. If we have the engine as described before, we can make a locomotive that will do all that I have just stated. Of course it is hard to tell what the future will bring us, but I am convinced that we will have better streets in the future than we have to-day.

TESTS ON THE ENGLEWOOD AND CHICAGO ELECTRIC STORAGE BATTERY ROAD.

A large number of tests were recently made of Chicago's storage battery road with a view of ascertaining the exact cost of operating such a system.

These tests were put in charge of Mr. George A. Damon, who was ably assisted by Prof. T. P. Gaylord and a corps of students from the Armour Institute.

The boiler plant of this road consists of three Heine water-tube boilers rated at 200 boiler horse power each, fitted with Roney mechanical stokers. The engines are triple expansion condensing, of the Willans central-valve type. The plant at present contains two of these engines. Each engine has two lines of tandem cylinders, and is rated at 200 horse power at a speed of 380 revolutions per minute.

The engines are directly connected by means of the "Arnold system" to four six-pole shunt-wound Walker power generators, rated at 190 kilowatts each when running at 380 turns per minute. They are designed to deliver their rated output at a voltage varying between 160 and 190 volts.

Each engine exhausts into a jet condenser, from which the condensed steam and heated injection water is raised by means of the air pump about 35 feet to the top of a cooling tower, in the bottom of which it collects ready to be again used in the condenser.

The boiler-feed pumps are of the duplex compound type, and ordinarily take their supply from the well of the cooling tower, pumping it through a closed feed-water heater in the exhaust line of the pumps and thence through the economizer to a common feed-water header above the boilers.

The hot flue gases from the boilers pass from the uptakes into a brick smoke flue extending the entire length of the boiler room. The economizer consists of eight rows of 24 pipes each, making a total of 192 pipes.

The stack is self-supporting and is constructed of steel. It is 150 feet high and 7 feet in diameter.

In making the tests water was measured by means of three tanks just before it entered the feed pumps. The steam used by the stoker engine, by the economizer engine, by the calorimeters, by the

feed pump and by the air pump was condensed and carefully measured. The blow-off from the boilers and other unused piping was opened up to guard against the water escaping through unknown leaks. All water not accounted for by the auxiliaries was charged against the engines, with the exception of a liberal allowance for leakage in the live-steam line.

All scales, steam gauges, thermometers, indicator springs, electrical and other instruments used were carefully calibrated.

The first test was with the plant running with two boilers, two engines and three generators. The second test was with practically the same load, carried by one boiler, one engine and two generators, while the last test was made under practically the same conditions as the second test, with the exception that the three-voltage method of charging the batteries was abandoned. In this test but one generator was used and the batteries were charged in successive sets, all at a common potential, the voltage being raised as the batteries became charged in such a way that the load upon the generator was kept nearly constant.

The coal used was from Fairmount, W. Va., and cost, delivered at the power house, \$1.90 per ton. An average of five determinations of its calorific value by the Berthier method gave 10,145 British thermal units per pound. The average of six analyses give the following result:

Moisture.....	6.326 per cent.
Volatiles and combustibles.....	32.903 "
Fixed carbon.....	48.126 "
Sulphur.....	2.700 "
Ash.....	10.030 "

In the first power house test the average steam pressure by gauge was 168.3 lbs. The trial lasted nine hours, during which 7,000 pounds of coal was burned and 43,323 pounds of water evaporated. The water evaporated per pound of fuel from and at 212° was 8.22 pounds, the percentage of the total calorific power of fuel utilized being 62.86. The maximum indicated horse power of the engine was 246 and the minimum 202, the average indicated horse power being 217. The gauge pressure showed an average of 171.3 pounds.

The test showed that the engines used 18 pounds of steam per indicated horse power. The conditions of the test were not favorable, however, to either an accurate engine test or to the most economical operation of the engines. The steam pressure was lower than it should have been, while the vacuum was but 21.25 inches. The engines were also overloaded during the entire run and were operated at 363 instead of 380 revolutions per minute.

The average efficiency between the horse power developed in the cylinders and the electrical power delivered on the switchboard was shown to be 79.27 per cent., the watt hours per pound of coal being 155.2, making the cost of coal per net kilowatt hour at the switchboard .611 cent. This high price is to be explained, not by the inefficiency of the station, but by the fact that a high price is paid for a poor coal. With a more advantageous arrangement in the purchase of coal, there is no reason why this station should not develop a kilowatt-hour for less than .3 cent.

The pumps used 14.36 per cent. of the water evaporated by the boilers, this not being however a total loss as the exhaust was used for heating the feed water. A friction load of 32.26 indicated horse power was shown with one engine operating one generator running on open circuit.

The efficiency of the battery is shown as follows:

Kilowatt-hours, first charge.....	30.757
Kilowatt-hours, discharge.....	19.715
Kilowatt-hours, second charge.....	81.631

The efficiency in the first case is 53.6 per cent. and in the second 62.32 per cent. As is shown above, the two charges differ considerably.

This is due to the fact that the charging of the battery was left to the regular operators of the plant, who used their judgment both as to the voltage and as to the time the battery should charge at each volt.

age. They also determined when the battery was fully charged. In the first charge there is no doubt but that the final voltage was too high, and in the second charge it would seem that the battery was charged too long, both of which conditions reduced the efficiency obtained. The result, however, shows the efficiency in actual service, but does not represent the possibilities of the battery.

The amount of the first charge was, of course, influenced by the immediate previous history of the battery, and for this reason the efficiency obtained by using the second charge as a basis is the more reliable. The test showed that the car used 1.41 kilowatt-hours per car-mile, as measured at the charging table, and .87 kilowatt-hour per car-mile was delivered from the batteries to the motor on the car.

The acceleration test showed a speed of 4 miles per hour five seconds after starting, 8 miles per hour ten seconds after starting, and 15 miles per hour one minute after starting, the maximum amount of current used being 320 amperes. Four sets of batteries were, however, in use at that time in parallel, so that this total of 320 amperes indicated a total discharge rate of each cell of but 80 amperes.

In conclusion it may be said that the foregoing tests do not demonstrate the best results that may be expected of accumulator traction, and were not made for that purpose. No excuse is to be offered for the fact that the road was not operating under ideal conditions while being tested, as the primary object of the test was to determine where improvements could be made. If this is kept in mind when comparing the results with those obtained upon the trolley systems of about the same size, it will be seen that the cost of fuel for accumulator traction of something less than one cent per car-mile is very favorable to storage-battery traction.

The batteries have operated from eight to fourteen thousand miles and are said to be standing the service remarkably well.

Magnetic Wind.

The explanation of the phenomenon of "electric wind," meaning the discharge from points accompanied by a blast of air, says the *London Electrician*, has taxed the successive theories of electric discharge to the utmost. That air can be electrified has been generally denied by the more recent workers, and the effect upon air has, since Helmholtz, been attributed to a dissociation of the gaseous molecules. Unless a higher than atomic dissociation is assumed, this hypothesis meets with serious difficulties in the case of monatomic gases. There remain the wave theories sketched out by Hertz, Goldstein and others, which embrace all vacuum discharges. But O. Lehmann has recently carried out an investigation of the phenomena of electric and "magnetic" wind, which tends to put these theories out of court.

It appears that the air currents between two opposed points, made visible by tobacco smoke or by a heavier gas, can be explained by the projection of two opposed currents of particles or ions, which produce a motionless layer in the middle. If for any reason a layer of air requires a different dielectric capacity from the rest, partial discharge takes place within it, which gives the appearance of a stratified discharge. Electric wind is the cause of the unsymmetrical shape of the arc, which is blown away from the negative pole. If the electric wind occurs in a strong magnetic field the stream lines of the ions, and hence also of the air, must be changed in obedience to the electromagnetic forces, since a moving ion is equivalent to an electric current.

This may be well shown by means of the arc, which rotates in a magnetic field originally devised by Andrews. One of the poles is a plate with a circular perforation, the other is a carbon rod with its end in the center of the circle. The arc playing between the rod and the inner edge spins round rapidly in a magnetic field with its lines of force parallel to the rod. If an alternate current with 100

reversals per second is used, it often happens that the arc spins round 50 successive times in the same direction between every two reversals. The spiral paths of the carbon particles show that it is a case of magnetic wind, and not an influence upon an ether phenomenon.

In a large highly exhausted "electric egg" the author recently noticed a curious phenomenon in this connection. It was an appearance resembling a comet, consisting of negative glow light and a brush or tail, which projected from the cathode in an eccentric direction. On approaching a magnet to it from the outside it began spinning around the axis of the vessel, the rate increasing with the proximity of the magnet, and reversing on reversing the poles. The author seeks an explanation in the eccentric impact of a stream of air upon the cathode. [*Wied. Ann., No. 13, 1897.*]

Smallest Electric Motor.

D. Goodin, a watchmaker of McKinney, Tex., has constructed what is supposed to be the smallest electric motor in the world. The motor weighs but 9.160 of an ounce and does not cover a silver dime. Mr. Goodin wears it as a scarf pin. The front of the motor is of gold, highly polished, and the commutator segments are also of the same metal, so that viewed from a little distance the scarf pin has the appearance of a very valuable and rather curiously designed pin. It is only when standing near to Goodin when he is wearing the scarf pin that its nature can be discovered. The first thing to attract the attention is the buzzing of the machine, which, by means of a current obtained from a small chloride of silver battery carried in the vest pocket, is kept in operation at a high rate of speed, and with a noise like a small nest of hornets. The field magnets of the little motor are made of two thicknesses of No. 22 sheet iron scraped down and polished. These are held together with gold screws and wound with No. 26 silk covered wire. The armature is of the four pole type and is wound with No. 36 wire. The little brushes are of marvelous thinness, having been constructed of copper, hammered down with much patience and care. There is a small gold switch on a black rubber base, made with a pin, to be worn on the lapel of the vest.

Patent Amendments.

The House Committee on Patents has acted favorably on the bill amending the patent law of March 3, 1897, so as to limit the restrictions against patenting an article on which a foreign patent had already been issued, or previously described in a foreign publication. The bill provides that the restriction shall not apply to applications made within sixty days from the passage of the proposed amendment.

By an act of Congress approved March 3, 1897, the law relating to patents was amended so as to provide that no patent shall be granted in this country for an invention previously patented in a foreign country on an application filed more than seven months prior to the filing of the application in this country. By the terms of this act it went into effect on January 1, 1898, and all applications not reaching the Patent Office before that date were debarred from the benefits of the law. It has been found upon investigation that this radical change in the law that existed for almost a century has worked much wrong and hardship to American inventors generally, and in many cases has injured citizens of other countries who extend to us reciprocal favors of like character.

The effect of the enactment of this bill will be to extend the manifest intention of Congress to afford to a peculiarly situated class of inventors an opportunity to come in within a certain time, and, as heretofore, avail themselves of a long existing law, and thus incidentally also to legalize those applications for patents which, by reason of unavoidable accident, mistake, ignorance, lack of opportunity or

the like, have been delayed in the filing until after the 1st of January, 1898, and which by reason of the circumstance that their subject-matter had been previously patented abroad for more than seven months are, by the radical changes wrought in the uniformly existing previous law by the act of March 3, 1897, now either void or destined to become burdensome upon the Patent Office and to those concerned.

In view of the importance as well as fairness of the proposed measure, and the many reasons that can be urged in favor of its speedy enactment, there is every reason to believe that it will soon be on the statute books.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

PARTIAL LIST OF EXHIBITORS AT THE ELECTRICAL AND KINDRED INDUSTRIES EXHIBITION,

Madison Square Garden, New York, May 2—31, 1898.

We take pleasure in publishing a partial list of exhibitors in the Electrical and Kindred Industries Exhibition which is to take place at Madison Square Garden, New York, between May 2 and May 31 of the present year. The large number of well-known firms who have taken space practically assures the success of the Exhibition, and simply goes to show the interest this most laudable enterprise is creating. The list is as follows:

Armstrong Interior Conduit Co., Pittsburg.
American Rheostat Co., Milwaukee.
American Electric Cold Supply Co., Brooklyn.
American Pulley Co., Philadelphia.
American Watchman's Time Detector, 284 Broadway, N. Y.
American Engine Co., Bound Brook, N. J.
Adams-Bagnall Electric Co., Cleveland.
Armington & Sims Co., Providence, R. I.
American Electrician Co., New York.
American Elec. & Maintenance Co., 451 Greenwich st., N. Y.
American Electrical Works, Providence, R. I.
Bossert Electric Construction Co., Utica, N. Y.
Baylis Co., The, 99 Cedar street, New York.
Bernard, E. G., Troy, N. Y.
Borne, Strymer Co., 80 South street, New York.
Belknap Motor Co., Portland, Me.
Brewster Engineering Co., 27 Thames street, New York.
Crocker-Wheeler Electric Co., 89 Cortlandt st., New York.
C. & C. Electric Co., 143 Liberty street, New York.
Corey, B. B., 26 Cortlandt street, New York.
Coho & Co., H. B., 220 Broadway, New York.
Christensen Air Brake Co., Milwaukee.
Card Electric Co., Mansfield, O.
Cleveland Twist Drill Co., Cleveland.
Crouse-Tremaine Carbon Co., Fostoria, O.
Connecticut Telephone & Electric Co., Meriden, Conn.
Crown Woven Wire Brush Co., Salem, Mass.
Cook's Sons, Adam, 813 West street, New York.
Campbell Underground Trolley Co., Towanda, Pa.
Camp Co., H. B., Aultman, O.
De La Vergne Refrigerator Co., E. 133th street, New York.
Diamond Electric Co., Peoria, Ill.
Diesel Motor Co. of America, 11 Broadway, New York.
Edison, Thomas A., Orange, N. J.
Edison Electric Illuminating Co., New York.
Eddy Electric Manufacturing Co., Windsor, Conn.
Electric Storage Battery Co., Philadelphia.
Excelator Electric Co., Brooklyn.
Edison Manufacturing Co., Orange, N. J.
Edison, Jr., Thomas A., 98 Broadway, New York.
Electrical Engineer, New York.
Electrical Review, New York.
Electrical Age, New York.
ELECTRICITY Newspaper Co., New York.
Fisher Foundry & Machine Co., Pittsburg.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Fuel Economizer Co., Matteawan, N. Y.
Fostoria Incandescent Lamp Co., Fostoria, O.
Fiberite Co., Mechanicsville, N. Y.
Fairchild & Sumner, 39 Cortlandt street, New York.
Gold Car Heating Co., Cliff and Frankfort sts., New York.
Harrison Safety Boiler Works, Germantown Junction, Pa.
Highland Chemical Co., Connelleville, Pa.
Haines Co., William S., Philadelphia, Pa.
Haring Steam Plant Equip. Co., 26 Cortlandt st., New York.
Ideal Electric Corporation, 13th and Hudson sts., N. Y.
Imperial Porcelain Works, Trenton, N. J.
India Rubber & Gutta Percha Insulating Co., Glenwood, N. Y.
Jones & Son, J., 69 Cortlandt street, New York.
Johnston Co., W. J., New York.
Keuffel & Esser Co., 127 Fulton street, New York.
Kelley & Sons, B. F., 91 Liberty street, New York.
Keystone Electrical Instrument Co., Philadelphia.
Lawrence Machine Co., Lawrence, Mass.
Lewis Tool Co., 44 Barclay street, New York.
Lynn Incandescent Lamp Co., Lynn, Mass.
Morris, Elmer P., 15 Cortlandt street, New York.
Machado & Boller, 208 Broadway, New York.
Mowrey & Co., P. M., 318 Broadway, New York.
Niles Tool Works Co., Hamilton, O., & New York.
National Motor Co., 118 Chambers street, New York.
Nowotny Electric Co., Cincinnati.
National Carbon Co., Cleveland.
Nash Gas Engine Co., 99 Cedar street, New York.
New Britain Machinery Co., New Britain, Conn.
N. Y. Safety Steam Power Co., 30 Cortlandt st., New York.
Oswego Boiler Works, Oswego, New York.
Otis Electric Co., 36 Park Row, New York.
Onondaga Dynamo Co., Syracuse, New York.
Paragon Arc Lamp Co., Boston.
Peru Electric Mfg. Co., Peru, Ind.
Peckham Motor Truck & Wheel Co., 26 Cortlandt st., N. Y.
Patrick, Carter & Wilkins, Philadelphia.
Paragon Motor Co., 39 Cortlandt st., New York.

Porter & Remsen, 39 Cortlandt st., New York.
Roebbing's Sons Co., Jno. A., Trenton, N. J.
Safety Insulated Wire & Cable Co., 229 West 28th st., N. Y.
Stephenson Co., Ltd., John, 47 East 27th street, New York.
Sillex Insulation Co., 39 Cortlandt street, New York.
Sprague Electric Co., 20 Broad street, New York.
Simonds Mfg. Co., Pittsburgh.
Sinclair, D. J., Caledonia, New York.
Street Railway Journal Co., New York.
Translucent Fabric Co., Quincy, Mass.
Thomas & Sons, Co. R., East Liverpool, O.
United States Electrical Supply Co., 141 East 25th st., N. Y.
Vacuum Oil Co., Rochester, New York.
Van Horne, Burger & Co., Dayton, O.
Worthington, Henry R., New York.
Walker Co., Cleveland.
Weston Electrical Instrument Co., Newark, N. J.
Warren Electric Mfg. Co., Sandusky, O.
Williams & Co., J. H., Brooklyn.
Wendell & McDuffie, 26 Cortlandt street, New York.
White, J. G., & Co., 29 Broadway, New York.
Western Electrician, Chicago and New York.
Worthington Water Tube Boiler, 30 Cortlandt street, N. Y.
Zimdars & Hunt, 127 5th avenue New York.

The New York Electrical Society.

The New York Electrical Society was organized in 1881 "for the advancement of electrical knowledge and the study of electrical and other scientific phenomena."

In carrying out this purpose, the endeavor of the officers of the Society has been to make it a help and a stimulus to young electricians and an up-to-date means, for the general public, of discussing and illustrating the most recent and interesting developments in electrical work.

Any person of good repute, who is connected with or interested in electrical work, is eligible for admission to the Society. An application blank, which will be forwarded by the secretary on request, must be filled in with the name, address and occupation of the applicant, and returned. The name will be endorsed by a member and duly presented for election. The entrance fee and yearly dues during 1898 (Exhibition Year) are \$3.

It is well known that from the inception of this body to its one hundredth meeting in 1887 a standard of papers and discussion was set which established the reputation of the Society as exerting a most beneficial influence in the dissemination of current electrical knowledge and progress.

The following is the Society's programme of papers to be read, etc., during the remainder of the current season:

"Evolutions in Electric Traction," by Prof. Sidney H. Short.

Paper on subject not yet announced, by Prof. Elihu Thomson.

A visit to the new Union Station of the Brooklyn Edison Company at Bay Ridge, L. I.

"Electrical Tools," by Dr. Schnyler S. Wheeler.

"The Theory, Practice and Future of the Electric Incandescent Lamp," by Thomas A. Edison, Jr.
A Visit to an Underground Trolley Station.

Personal.

Mr. E. D. Matthews of the Trenton Falls Power Company of Utica, N. Y., recently spent a few days in this city on business connected with the company.

Drawbacks—The Kind to Get.

A certain class of our citizens complain of the hardship of our manufacturers not being able to compete successfully for foreign trade on account of the duties imposed on materials used in the manufacture of goods for export. Such talk is due to ignorance of important provisions of the tariff. The whole policy of the Government has been, and is, to foster our domestic manufactures, and with this object in view the Dingley bill very wisely provided that the manufacturers shall be allowed and paid a rebate or drawback of 99 per cent. of the amount of duties paid on materials used in the manufacture of export goods, whether the export article is manufactured wholly or in part from imported materials.

If this provision of the present tariff were more widely understood and the manufacturers knew how

to go to work to obtain the drawback, we believe that our exports would largely increase in the near future. The obtaining of the drawback would in many cases mean that our manufacturers could name a price on their goods which would result in their greatly increasing their export business or opening up one. The manufacturers do not have to export direct, but are entitled to drawback when shipments are made through commission houses. We can refer our manufacturers to a firm of customs brokers, F. E. Wallace & Co., 203 Broadway, New York, who are making a specialty of collecting drawbacks from the Government for the manufacturers.

With free material, which is practically accorded our manufacturers under the provision referred to, we may look confidently for largely increased exports.

LEGAL NOTES.

Judge Lacombe in the United States Circuit Court, New York, has handed down a decision in the suit of the Thomson-Houston Electric Company against the Walker Company of Cleveland and the Union Railway Company on the Van Depoele trolley patent, and ordering an injunction against the Walker Company and the other defendants. The order, however, directs that the injunction, when issued, shall be stayed for 30 days, to give defendants an opportunity to review the decision at this term of the Court of Appeals.

Judge Grosscup, at Chicago, has denied Charles Austin Bates' bill for injunction against the General Electric Railway Company. The bill was filed last October and the finding was given last week. Bates alleged that he was the owner of a large amount of stock in the General Electric Railway Company and that he was being swindled out of it. He prayed an injunction restraining the company from disposing of any more stock and then he asked the appointment of a receiver.

The City Electric Railway Company of Port Huron, Mich., has commenced suit in the Circuit Court against the Guarantors' Liability Indemnity Company of Pennsylvania to recover \$2,000. The company sets forth in its petition that its officers entered into a contract with the Pennsylvania Company whereby that concern guaranteed to pay all damages arising from accidents to passengers. For this protection the railway company paid \$1,500 a year. On December 5, 1896, Conrad Luz, a passenger, was injured. He brought suit against the railway company and secured a verdict of \$1,000. Costs and attorney fees brought the amount up to \$2,000. The railway company paid the amount and presented a bill to the indemnity company. The company for some reason refused to pay, and the above suit was brought.

The Court of Appeals at Albany has affirmed with costs the judgment of the lower court in the case of Robert H. Sherwood and Ralph C. Swan against Maitland E. Graves, appellant. Plaintiff sued for a special compensation of \$2,500, which it is alleged was agreed to be paid to him by Graves under a special contract for the acquisition of all the bonds, stocks, judgments and other liabilities of the Staten Island Belt Railroad Company for the sum of \$65,500 and for the further sum of \$550 for obtaining for defendant the privilege of paying the purchase price of said indebtedness in part in bonds of an Oswego electric company. Swan, who acted as the agent of Sherwood in this transaction, by an order of the Supreme Court was made a party plaintiff to the action. In the lower court plaintiff recovered judgment in the sum of \$3,006, and defendant's motion for a new trial was denied.

In the case of Frank Campbell, a lamp trimmer in the employ of the Binghamton (N. Y.) General Electric Company, whose hand was injured by becoming entangled in the wires of a lamp he was trimming through the alleged carelessness of the driver of an express wagon who drove his team against the lowered wire, breaking it, although the trimmer had given what he claimed was sufficient warning, and

which was accepted as such by two other teams preceding the express wagon, for they drove to one side to avoid the wire, the jury gave the plaintiff a verdict for \$7,000, which, with the plaintiff's consent, was subsequently reduced to \$4,000. The express company against whom the suit was brought appealed the case and the Third Appellate Division has directed a reversal of the verdict, holding that no negligence was shown on the part of the driver of the express wagon, and that plaintiff was shown to have been guilty of contributory negligence. "We are unable to believe," Justice Putnam said, "that negligence could be properly attributed to the driver of the express wagon, lawfully traveling on the public highway, for failing to observe the leg wire which the plaintiff had placed across it. One using a public street has no reason to apprehend danger, and is not required to be vigilant to discover dangerous and unusual obstructions."

Thomas Hill and a number of other holders of the Hudson Telephone Company's stock have asked the courts to institute an investigation of the affairs of the company and to appoint a receiver for it. The president, Charles B. Thurston, and Manager G. H. Atkinson have both tendered their resignations. The company was organized in Jersey City in 1895 with a capital stock of \$300,000. It was formed in the interests of the Best Telephone Company, which is now in process of liquidation. According to the bill of complaint, the Hudson Telephone Company was to pay certain royalties for the use of the transmitter and receiver patents held by the Best Telephone Company, which royalties it is alleged are excessive. The bill further alleges that the Hudson Telephone Company is interested in the New Jersey Telegraph & Telephone Construction Company, and that the promoters of the former practically contracted with themselves in awarding the contract for constructing the lines, which contract, it is alleged, was never advertised according to law. It is alleged that several heavy judgments are pending against the company and that it is practically insolvent.

GENERAL NEWS.

What is Going On in the Electrical World.

Albany, N. Y.—The State Railroad Commission on the 9th inst. considered the application of the Van Brunt Street & Erie Basin Railway Company of Brooklyn to change its motive power from horse to electricity. There was no opposition. The commission reserved its decision.

Annapolis, Md.—A bill has been introduced in the Legislature to authorize the Baltimore & Washington Transit Company of Maryland to construct and operate its railway from the District of Columbia line to the Pennsylvania line, through Prince George's, Montgomery, Carroll and Frederick Counties, Md. The line has already been constructed for some distance, and is designed to pass through Sandy Spring.

Atlanta, Ga.—The electric light committee of council have adopted a resolution recommending the appointment of an electrical engineer to figure on the cost and maintenance of an up-to-date municipal electric light plant, also recommending the appropriation of \$1,000 to defray the cost of the investigation.

Augusta, Me.—The Kennebec Light & Heat Company has determined on building a new power house, made necessary by a large increase in business. The new power station, plans for which are being prepared by Portland parties, will have all the modern machinery and be up to date in every respect.

Baltimore, Md.—A deal has been concluded by which the Central Railway will pass into the control of the Baltimore City Passenger Railway Company and be operated as a part of that company's system. The City Passenger Railway Company agrees to pay \$100 a share to the holders of the \$300,000 worth of stock of the Central, and will also assume the entire bonded indebtedness of that road, amounting to something like \$1,100,000.—F. B. Brownell, the car manufacturer of St. Louis, signed a contract last week to furnish the Baltimore Consolidated Railway Company with sixty new cars.

Bridgeport, Conn.—Judge Elmer of the Superior Court has granted the Bridgeport Traction Company permission to extend its line to Westport. This is a big victory for the trolley company over the New York, New Haven & Hartford Railroad Company. It gives the Traction Company the connecting link of four miles between roads from Bridgeport to Stamford.

Brooklyn, N. Y.—President Baldwin of the Long Island Railroad has approved plans submitted to him for a trolley road which will connect the tracks of the Long Island Railroad with Rockaway Beach. By the proposed arrangement trains will be run from Long Island City and Brooklyn to Hammill's Station, where passengers will be transferred to trolley cars.—The Edison Illuminating Company of Brooklyn has just

closed a contract with the Henry R. Worthington Company for electric power for the pump works at Van Brunt and Rapelyea streets, the great pump company having decided to substitute electricity for steam in the operation of its machinery.—Four additional lines of trolleys began running over the Brooklyn Bridge on Sunday last. This makes six different lines of trolley cars now using the Bridge rails.

Bucyrus, O.—The directors of the Turner Engineering Company have decided to add to their works a complete department for the manufacture of all kinds of electrical appliances.

Burlington, Vt.—The Vermont Electric Company expects to have its power house on the Winooski river fully equipped within a few weeks. Two 225-k. w. Westinghouse three-phase generators are to be installed as soon as they are received from the works, and the other machinery will be put in place as rapidly as possible. The water power which is to be used in operating the generating plant lies between Essex Junction and Burlington. Between these points the river had cut an immense gorge through the rocks, averaging 100 feet in depth. At the head of the gorge, about two miles from Burlington, the stream divides, leaving a high rocky island in the center. Here the Vermont Electric Company has erected its power house.

Chicago.—W. T. Baker, former president of the Board of Trade, owns a water fall near Tacoma, Washington, that he intends to harness and make it furnish electric power to light the cities of Tacoma and Seattle and run all the mills and factories in the two places. It is expected that an average of 30,000 horse power can be secured. The property owned by Mr. Baker includes the famous Snoqualmie Falls, thirty-six miles from Tacoma and twenty-three miles from Seattle.

Chester, Pa.—A deal has been consummated by which the Chester Traction Company's trolley lines have passed into the hands of Philadelphia capitalists. The persons into whose hands the management has passed are represented by E. W. Clark & Co., the brokers, of Philadelphia. The purchasers have also acquired the Wilmington trolley roads, and the two will be united so that a complete system will be established between Chester and Wilmington.—At a meeting of the Chester Traction Company held on the 8th inst., George B. Lindsay and the board of directors resigned, and C. M. Clark was elected president, and C. Ford Stevens, George B. Lindsay, J. E. Moore, H. C. Howard and C. M. Clark elected directors. C. Ford Stevens was elected secretary and treasurer. A meeting of the Union Railway Company was also held, when President Lindsay and the board of directors resigned, and J. E. Moore was elected president and a new board of directors elected.

Chesterfield, Mass.—The long talked of extension of the electric road from Williamsburg to this town is, under the guidance of John C. Hammond, beginning to assume an appearance of reality. At the outset some entertained the idea that the road might go through Goshen, but as the idea is ultimately to form connection with Pittsfield, and as a road through Chesterfield is more direct, the layout will undoubtedly be here. Farms along the proposed route are being purchased by city residents with the view of converting them into summer homes. The road will probably be constructed early in the spring and promises to be a very popular and successful line.

Cincinnati, O.—A \$10,000 bond has been filed with Solicitor A. N. Kinney, of Mt. Healthy, by the Cincinnati & Hamilton Electric Railway Company, obligating the company to construct and operate an electric railway from Hamilton to College Hill within the next 14 months.

Columbus, O.—The new stockholders of the Columbus Electric Light & Power Company have elected the following directors: Mr. George W. Bright, Mr. A. P. Lathrop, Mr. W. F. Kelley, Mr. Fred Hubbard and Mr. O. A. Miller. There will be nine members in the full directory; the remaining four will be chosen at a meeting to be held for the purpose.

Easton, Pa.—Hon. James Kerr, of Clearfield, president of the new Northampton Electric Railway Company, says he intends to start men out immediately to secure right of way for the proposed electric road connecting Easton and Bethlehem. It is the aim of the company to begin the work of construction early in April.

Elroy, Wis.—The question of electric lights for the city is again being agitated. Responsible parties have been conferring with E. S. Willey, who holds a franchise for putting in a plant which expires April 5, with the expectation of eventually making arrangements with him.

Fall River, Mass.—E. P. Shaw, Jr., of Boston, general manager of the Island Tramway to be built between Newport and Fall River, Mass., expects to have the road in running order June 1. The foundation for the power house in Portsmouth has been started.

Fenton, Mich.—A committee of the common council is investigating the subject of municipal ownership of electric lights with the idea of the village acquiring control of the plant which now supplies light for the streets.

Fort Scott, Kan.—The city council has taken formal steps to call a special election to vote \$150,000 for the establishment of water-works and an electric light plant.

Fort Wayne, Ind.—The Fort Wayne Electric Corporation turned out fifty-four incandescent dynamos dur-

ing the month of January. This is the best record ever made by the works for one month.

Frankfort, N. Y.—Beckwith & Quackenbush have been granted a franchise for an electric railway to run through this village.

Laconia, N. H.—The Laconia car shops started up on the 7th inst. on several large orders, one of which is for fifty electric cars for the Boston Elevated Railroad Company, to be delivered by May 1.

Lebanon, Ill.—The Wabash & Mississippi Construction Company, lately organized to build an electric railroad from Vincennes, Ind., to St. Louis, Mo., on the line of the old State road, is rapidly pushing the work of securing the right of way. The Leffler electro-magnetic system is contemplated. This uses neither overhead wires nor the third rail. Work on the road will be started in the spring, and it is claimed that sufficient capital has been secured to insure its completion. Passengers, traffic and light freight will be carried.

Lima, O.—The town trustees have accepted the offer of the company which proposed to supply this town with electric lights, and enough citizens have already subscribed to make the scheme a certainty.

Louisville, Ky.—An electric railway to St. Matthews is one of the future's strong probabilities. It is understood that a charter has been asked for and when granted work will begin at once.

Montreal, Can.—The transforming house of the Citizens' Power & Light Company at Cote St. Paul has been destroyed by fire. Loss, \$100,000.

Mount Pleasant, Pa.—A project to connect Greensburg and Mount Pleasant by an electric street railway line is being backed by Allegheny capitalists. The new line will pass through Spottsdale and terminate at Broadford.

New York.—The Edison Electric Illuminating Company has purchased an entire block fronting on the East River, between Thirty-eighth and Thirty-ninth streets, on which the company will erect an electric light and power plant of imposing dimensions. The price paid for the site was \$345,000.

Norwalk, Conn.—The Westport & Saugatuck Street Railway Company's stockholders are disposing of their stock at \$10 per share to New York and New Jersey capitalists who intend to extend the road to Danbury via Norwalk and make other changes deemed necessary.

Ocean City, N. J.—The ordinance granting a franchise to the People's Electric Light Company has been adopted by the council over the mayor's veto.

Parkersburg, W. Va.—The new Electric Light & Street Railway Company has purchased the Park City Street Railway for \$20,000. All of the old bonds have been taken up and paid for. The new company has surveyed and mapped out all its lines and will begin work on the electric system throughout the city and suburbs immediately.

Peoria, Ill.—The Peoria & Pekin Traction Company has been granted a franchise in South Peoria.

Penn Yan, N. Y.—A change in the route of the electric railroad which it is thought will be constructed between Penn Yan and Lyons is considered advisable. It is now proposed to run the road to Geneva by the way of Benton Center and Hall's Corners. The promoters of the scheme are Baltimore capitalists who are interested in the construction of trolley roads. A stock company will be formed, with a capital stock of \$400,000, if the building of the road is finally decided upon.

Redlands, Cal.—The scheme for the generation of electric power in Mill Creek canyon is being carried out and considerable work has already been done. The plant, which will cost \$250,000, is expected to be in operation by the middle of July. The company will furnish electricity for lighting and power in Redlands, Perris, San Jacinto, Elsinore, Lake View, Wildomar, Colony Heights and Box Springs and to mines and ranches in the vicinity.

Richmond, Va.—The Senate Committee on Roads has reported favorably the bill to incorporate the Peninsula Railway Company. This is one of the companies that propose to build an electric line from Newport News to Old Point. There is at present a line in operation between those places.

San Diego, Cal.—The sale of the Citizens' Traction Company has been postponed until the 21st inst.

Santa Cruz, Cal.—Surveyors have commenced to survey reservoir sites in the vicinity of Big Creek, and will survey a line over the mountains to San Jose to furnish power for electrical purposes.

Schenectady, N. Y.—It is announced that the Metropolitan Traction Company of New York has placed with the General Electric Company an order for \$300,000 worth of machinery for its new power station.

St. Paul, Minn.—The Sanborn street railway ordinance, authorizing the St. Paul City Railway Company to change its Selby avenue cable line into an electric trolley line has passed the board of aldermen. The railway company has decided to use the compound counterweight safety device as an auxiliary to the trolley on Selby avenue hill and has accepted the plans of Milton H. Brondson, chief engineer of the Union Railway Company of Providence, R. I., who designed the counterweight safety device which has been in successful operation on the Union Railway at Providence since it was changed to the trolley system.

Vicksburg, Miss.—The board of mayor and aldermen has granted a franchise to Percival Steel and others, of Chicago, for the construction of an electric street car service in this city. The terms of the franchise require of Mr. Steel and associates to deposit \$500 as forfeit and to file a bond of \$5,000 for the construction and equipment of four miles of road by December 1, 1898, and two miles additional in one year after, the work of construction to be commenced within five months from date of contract.

Washington, D. C.—The Columbia Railway Company intends to change its motive power from the cable to an underground electric system and extend its lines.

Windsor Locks, Conn.—The charter of the Suffield & Windsor Tramway has been purchased by Jesse W. Starr of Springfield, who in the last General Assembly secured a charter for the Springfield & Southwestern Railroad Company, giving him the right to build a trolley line from Springfield to Windsor Locks. The charter just acquired gives the added right to build a line through to Poquonock, where connection is to be had with Hartford.

Worcester, Mass.—A plan to have an electric street car line extending from Worcester to Milford, thence to Franklin, and thence to Woonsocket, by way of Wrentham, has assumed definite form. A petition was presented to the session of the Massachusetts Legislature two weeks ago, asking for a special charter for the Worcester, Milford, Attleboro & Woonsocket Street Railway Company, among the signers being George W. Wiggins, Joseph G. Ray, Edgar K. Ray and Orestes T. Doe of Franklin, Edward H. Rathbun of Woonsocket and Franklin W. S. Read of Leominster, C. W. Shippe of Milford, W. H. Tyler of Worcester, and others. The bill, as presented, petitions for the chartering of the enterprise, the bond issue to be \$350,000, with a stock issue of the same amount. The promoters of the scheme are all men of large means, backed by unlimited capital, and say that if their petition for a charter is granted all the capital necessary will be subscribed immediately afterward and the new line completed early next summer.

PERSONAL AND MISCELLANEA.

Robert H. Lerch of Easton, Pa., has been chosen general manager of the General Electric Company of Freeport, Ill., to succeed J. T. Schlacks, resigned.

The St. Louis "Star" says: "The latest appliances for propelling electric cars without overhead wires will be manufactured by the Mississippi Valley Electrical Company, which recently filed articles of incorporation. It is claimed that the inventions to be put on the market by this company will revolutionize street railway methods, and that they can be applied to any trolley line without the necessity for any alterations."

Thomas H. McLean, formerly connected with the electric street car systems of Brooklyn, N. Y., has been appointed general manager of the Toledo Traction Company's street-car system and electric light and power business at Toledo, to succeed S. S. Jewell, resigned.

Robert Fox, who had been general superintendent of the Scranton Railway Company, has accepted the position of general manager of the electric railway lines at Wilmington, Del., and Chester, Pa. Before leaving Scranton Mr. Fox was presented with a fine silver tea service by the employees of the Scranton Railway Company.

J. R. Crabb of Denver, Col., has invented a switch for electric street cars that does away with the rod the motorman is compelled to carry. It will throw a switch fifteen feet ahead of the car. By pressing down on a short lever the car will turn to the right, by raising upon the bar the car will go to the left or straight ahead as the case may be. It will work while the car is running fast as well as slow. Any switch that is now in use can be used.

John Edmund Ridall of Pittsburg, Pa., a popular business man and prominent in electrical matters, died at his home in that city on the 8th inst., almost at the moment that he was elected a director of the Allegheny County Light Company, which was holding its annual meeting at the time. Mr. Ridall had been since 1880 the manager and representative in Western Pennsylvania of the Brush Electric Company of Cleveland and introduced the arc light in Allegheny County. The Pittsburg "Dispatch" states that "a suit which Mr. Ridall instituted against the Brush Electric Company, involving about \$40,000, which he claimed as commission on sales, is still pending. It grew out of the merging of another electrical concern, with which Mr. Ridall had an iron-clad contract, into the Brush Company. In accordance with the terms of this contract Mr. Ridall laid claim to commission on all sales made in his district. One item which is specifically named is for commission on a \$300,000 arc light contract, made, it is said, with the city of Pittsburg." Mr. Ridall was twice married and twice widowed, his second wife dying in 1887. Five children survive—O. Hanson Ridall, John E. Ridall, Jr., Jacob Cook Ridall, Samuel Holland Ridall and Elizabeth Eakin Ridall.

Joseph A. McElroy of New York has gone to England partly to supervise the building of an electric road in Glasgow and partly on the invitation of an English syndicate to explain the merits of the McElroy-Grunow third-rail electric system, which has been patented in this country and also in Europe. Mr. McElroy is a Bridgeport, Conn., boy, and the "Standard" of that town has a very favorable opinion of the invention to which he has given his name in connection with that of

William Grunow of West Point, who has a residence in Bridgeport. The "Standard" says: "Both Mr. McElroy and Mr. Grunow are enthusiastic over their new device in the third-rail line, and they say that it goes far ahead of any system which has yet been invented. That this claim is a just one has been recognized by the English syndicate, and it has been taken up by the Englishmen and will be pushed with energy. The offers from English capitalists were so much better than those of the Americans it did not take long for the inventors to decide that they could do far better by sending the invention to England and planting it firmly in that country. That they will have the greatest success there is very little doubt felt, as many of the best European engineers have examined the system and have pronounced it to be far better than any yet brought to the front."

RECENT COMPANY ELECTIONS.

Alpena Electric Light Company, Alpena, Mich.—President, W. H. Johnson; vice-president, Henry Bolten; secretary, W. E. Hazell; treasurer, Donald McRae; directors: Henry Bolten, Donald McRae, W. H. Johnson, W. E. Hazell, H. H. Wittelschofer, J. H. Kerr, J. D. Turnbull.

Badger Illuminating Company, Milwaukee, Wis.—President, Henry C. Payne; vice-president, John I. Beggs; secretary and treasurer, C. A. Spofford; assistant secretary, F. H. Whitney; directors: H. C. Payne, C. A. Spofford, J. I. Beggs, F. G. Bigelow, Charles F. Pfister.

Bay Shore Electric Lighting Company, Bay Shore, N. Y.—President, Josiah Robbins; vice-president, Selah T. Clock; secretary, Freeman T. Hulse; treasurer, John R. Howell; directors: Josiah Robbins, Selah T. Clock, E. S. Bailey of Islip; U. P. Strong, Edward B. Mowbray, Freeman T. Hulse and John R. Howell.

Delta Electric Power Company, Delta, Pa.—President, C. F. Smith; vice-president, S. J. Barnett; secretary, C. O. McConkey; treasurer, W. Z. Macomber; superintendent, S. J. Whiteford; directors: V. G. Stubbs, S. J. Whiteford, C. F. Smith, C. O. McConkey, W. Z. Macomber, H. Clay Whiteford, S. J. Barnett.

Depere Electric Light & Power Company, Green Bay, Wis.—President, J. P. Dousman; vice-president, R. J. McGeehan; treasurer, William Workman; secretary, William Armstrong; manager, C. G. Wilcox; directors for three years: C. G. Wilcox and L. Minich.

Delaware Valley, Hudson & Lehigh Railroad Company, Stroudsburg, Pa.—President, Dr. J. B. Lung; treasurer, M. F. Coolbaugh; secretary, J. H. Shull; directors: J. B. Lung, C. A. Woolsey, Frank Pettit, J. Kellow, all of Brooklyn; J. H. Vanetten, of Milford; M. F. Coolbaugh, F. W. Ellenberger, E. F. Peters, W. S. Shafer and J. H. Shull of Monroe county, Pa.

Edison Electric Light Company, Mt. Carmel, Pa.—President, M. K. Watkins; vice-president, H. T. John; treasurer, S. E. Bergstresser; secretary, Reuben Kline.

Greensburg & Hempfield Electric Street Railway Company, Greensburg, Pa.—President, Thomas Donohoe, Sr.; directors: the president and F. Y. Clopper, John B. Head, W. F. Sadler, Sr., H. Beeten.

Hamilton Street Railway Company, Hamilton, Can.—President, William Gibson; vice-president, Edward Martin; directors: Wm. Gibson, M. P., Edward Martin, B. E. Charlton, John A. Bruce, F. W. Fearman, Wm. J. Harris, and Isaiah Beer.

Lackawanna Valley Traction Company, Scranton, Pa.—President, L. A. Watres; secretary and treasurer, Robert C. Adams; directors: L. A. Watres, Robert C. Adams, Mrs. E. M. Amerman, P. S. Page and R. A. Gregory.

Louisville Electric Light Company, Louisville, Ky.—Directors: A. H. Barret, Harry Bishop, J. B. Speed, G. W. Morris, J. M. Atherton, John Marshall, James A. Leech, Joseph Scheffler, M. R. Wheat.

Marietta Electric Company, Marietta, Ohio—President, A. L. Gracey, vice-president, Nelson Moore; general manager and treasurer, W. H. H. Jett; secretary, J. S. H. Turner; auditor, John Kaiser; directors: the officers and J. S. Simpson, H. W. Craig, I. O. Alcorn, Geo. B. Eysse.

Metropolitan Electric Light Company, Reading, Pa.—President, John A. Rigg; secretary and treasurer, K. A. Fichtelhorn; directors: R. N. Carson, William R. McIlvaine, R. L. Jones, H. C. England, Jas. A. O'Reilly, George H. Valentine, L. T. Custer, R. N. Buckley, John A. Rigg.

Milwaukee & Waukesha Electric Railway Company, Milwaukee, Wis.—Directors: John A. Kinney of New York, E. H. Bottom, C. E. Wild, C. L. Gross, Frank Koehler and S. I. Henderson.

New York & Staten Island Electric Company, Staten Island, N. Y.—Directors: H. H. Rodgers, Samuel Thomas, A. B. Fletcher, Joseph E. Bourne, Col. G. B. M. Harvey, Edward P. Doyle and John P. O'Brien.

Norfolk Street Railway Company, Norfolk, Va.—President, R. Lancaster Williams of Richmond; vice-president, Frank O. Briggs of Trenton, N. J.; treasurer, Walter H. Doyle of Norfolk; secretary and assistant treasurer, H. C. Whitehead of Norfolk; manager, W. M. Roseborough; directors: R. Lancaster Williams, Richmond; Frank O. Briggs, Trenton; J. W. Middendorf, Charles R. Spence and Robert C. Davidson, Baltimore; R. B. Cook, W. H. Doyle and J. P. Andre Mottu, Norfolk; William M. Habliston, Petersburg and Richmond.

Potomac Electric Power Company, Washington, D. C.—Directors: O. T. Crosby, Charles A. Lieb, F. C. Stevens, H. D. Mirick, W. S. Terry, James B. Lackey and Z. B. Deyber.

Reading Traction Company, Reading, Pa.—President, John A. Rigg; secretary and treasurer, M. A. Aulenbach; directors: John A. Rigg, Richmond L. Jones, Robert N. Carson, B. Nelson Buckley, O. S. Geiger.

Reading & Pottstown Electric Railway Company, Reading, Pa.—President, John A. Rigg; directors: the president and Richmond L. Jones, Samuel E. Rigg, M. C. Aulenbach, K. A. Fichtelhorn.

Reading City Passenger Railway Company, Reading, Pa.—President, B. F. Owen; vice-president, James L. Douglass; secretary and treasurer, H. A. Mühlenberg; directors: C. H. Schaeffer, H. A. Mühlenberg, John Rick, Charles Rick, A. Thalheimer, William R. McIlvaine and Mathan Harbert.

Southern Electric Railway Company, St. Louis.—Directors: Charles F. Orthwein, Henry Nicolaus, C. H. Spencer, Harrison I. Drummond, Joseph S. Minary.

Trenton Passenger Railway Company, Trenton, N. J.—President, Henry C. Moore; vice-president, Thomas S. C. Barr; secretary and treasurer, John L. Kuser; directors: Thomas S. C. Barr, Col. A. R. Kuser, John L. Kuser, Ferdinand W. Roebbling, Jonathan H. Blackwell, E. J. Moore.

United Traction Company, Reading, Pa.—President, John A. Rigg; secretary and treasurer, M. A. Aulenbach; directors: R. N. Carson, Wm. R. McIlvaine, R. L. Jones, H. C. England, James A. O'Reilly, George H. Valentine, L. T. Custer, R. N. Buckley, John A. Rigg.

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

COMMERCIAL PARAGRAPHS.

Thorburn Reid, whose card appears elsewhere in this issue, is designing electrical apparatus for several prominent manufacturing concerns. Mr. Reid makes a specialty of designing and supervising railway, light and power transmission plants, and also of designing alternators, synchronous alternating motors, induction motors, transformers and rotary converters and direct current dynamos and motors, guaranteeing their performance. Mr. Reid solicits correspondence (122 Liberty street, New York).

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

Any one desirous of obtaining electrical measuring instruments would do well to address the Cherry Electric Works, 25 and 27 Third Avenue, New York. This concern has recently placed upon the market an inexpensive but accurate voltmeter reading from 0 to 10 volts and an ammeter reading from 0 to 10 amperes. The price of these instruments is but \$1.50 each, and for experimental purposes, where the standard instruments would prove too expensive, these will be found both valuable and trustworthy. The mechanism is enclosed in a hardwood case, which gives them an extremely neat and handsome appearance. There is no doubt but what these instruments fill a long-felt want, as many amateurs have been kept from experimenting owing to the cost of the standard instruments.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

We would call our readers' attention to Mr. Charles J. Kintner's card which appears in this week's issue. Mr. Kintner, who is now practising as patent expert at 45 Broadway, New York, was for many years connected with the Patent Office in Washington as principal examiner and a electrical expert in charge of the electrical department. The Hon. L. Q. C. Lamar, late Secretary of the Interior, had a high regard for his ability and electrical knowledge concerning inventions, which reputation Mr. Kintner has fully lived up to since being in business for himself. As a patent expert Mr. Kintner stands high, as shown by the many important patents taken out by him in the past few years. When Mr. Kintner fails to obtain a patent on an invention it is safe to assume the invention is not patentable.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

INCORPORATIONS.

The Skagway Light & Water Company, Seattle, Wash. Capital stock, \$250,000.

The Weston Electric Appliance Company, Newark, N. J.—Capital stock, \$750,000, of which \$20,000 has been paid in. Incorporators: Edward Weston of Newark, Franz C. Matthieson of New York, and Henry E. Niese of Jersey City. The company will build plants at Waverly, N. J., a short distance south of Newark.

The Maurice River Water & Electric Power Improvement Company, Vineland, N. J.—to introduce electric power in

Vineland for manufacturing and other purposes. Incorporator: Charles K. Landis, the founder of Vineland.

The National Mill, Water & Light Company, Angola, Ill.—to put in a power plant by which to supply the town of Angola with a flouring mill, waterworks, electric light and a street railroad.

The Robb Conduit & Underground Electric System Company, New York City. Capital stock, \$25,000. Directors: F. D. Robb and Dr. G. E. Crittendon, of Hot Springs, Ark.; Fritz Andraea and Gertrude Hanbury, of New York City; and A. L. Wear, of Cornwall.

The El Dora Townsite Company, Denver, Col.—to own and operate land for a townsite, to own and operate mines and to sell electricity for power, etc.; operations to be carried on principally in Boulder County. Incorporators: R. P. Davy, Thomas G. Roberts and Job T. Lyon.

The Alaska Light & Power Company, Tacoma, Wash. Capital stock, \$25,000. Incorporators: I. W. Anderson and Fred C. Brewer.

The Needle Mountain Electric & Power Company, Denver, Col.—to operate in La Plata County. Capital stock, \$200,000. Incorporators: Lyman B. Jordan, John Lawson and George F. Carris.

The Sterling Electric Company, Chicago, Ill. Capital stock, \$30,000. Incorporators: Edward A. Biggs, John E. Hunt and Walter I. Hall.

The Mississippi Valley Electrical & Manufacturing Company, St. Louis, Mo. Capital stock, \$100,000, fully paid up. Incorporators: John R. Farmer, Daniel H. Lohse, Edward Buder, Anthony F. Ittner and Eugene Buder.

The South Illinois Electric Light Company, St. Elmo, Ill.—to operate an electric light plant. Capital stock, \$20,000. Incorporators: W. L. Stocker, G. W. Harlan and A. J. Johnson.

The Clear Creek Mill Company—to establish a large electric plant for the treatment of ores at Empire, Col. Paid up capital, \$30,000. Incorporators: B. F. Taft, F. R. Kimball, J. H. Ware, D. H. Kirby and others. Poston capital is back of the enterprise.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 8, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

598,580. Trolley-Head. Herbert W. Smith, Somerville, Mass., assignor to the F. L. Gaylord Company, Ansonia, Conn. Filed June 10, 1897.

598,661. Electric Street Car Trolley. Joseph T. Himmege, La Rue, Ohio. Filed Oct. 20, 1896.

598,731. Electric Railway. Martin T. A. Kuberschky, Berlin, Germany, assignor to the General Electric Company of New York. Filed March 26, 1897. Renewed Jan. 10, 1898.

598,538. Fender or Guard for Tramway Cars. John R. Seaton, Cohoes, N. Y. Filed Aug. 10, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

598,697. Electric-Arc Lamp. Sidney I. Crain, Cincinnati, Ohio, assignor of two-thirds to Stewart Shillito and Charles A. Irwin, same place. Filed July 21, 1897.

598,726. Incandescent Electric Lamp and Process of Making Same. John C. Fish, Shelby, Ohio, assignor to the Shelby Electric Company, same place. Filed Aug. 3, 1897.

598,733. Safety Cut Out for Electric Lamps. Alfred N. Lovelace, Knoxville, Tenn. Filed June 12, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

598,517. Testing Apparatus for Electric Circuits. Edward Heymann and Frank W. Heymann, Boston, Mass. Filed Feb. 26, 1897.

598,510. Construction of Dynamo-Electric Machinery. Alfred Soames, London, England, assignor to the Davies Motor Company, Limited, same place. Filed Dec. 6, 1897.

598,553. Electric Switch. Johan M. Andersen, Boston, Mass., assignor of one half to Albert Anderson, same place. Filed Dec. 5, 1896.

598,655. Coin-Controlled Machine for Automatically Distributing Electric Currents. John W. Dawson, Louisville, Ky. Filed Nov. 18, 1896. Renewed Dec. 23, 1897.

598,657. Alternating Current Dynamo. William B. Esson, London, England. Filed April 21, 1896.

598,679. Means for Use in Operating Electrical Switches. Thomas H. Parker, Tettenhall, England. Filed Dec. 9, 1897.

598,715. Automatic Electric Switch. Frank C. Perkins and John D. Killip, Buffalo, N. Y.; said Killip assignor to said Perkins. Filed Sept. 25, 1897.

598,861. Electric Time Switch. George F. Goodwyn, Arnprior, Canada. Filed April 26, 1897.

ELECTRIC HEATERS, ETC.

598,568. Method of Manufacturing Rheostats, Electric Heaters, etc. Harry W. Leonard, New York City. Original application filed April 9, 1897. Divided and this application filed Jan. 8, 1898.

598,638. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed March 21, 1894.

598,639. Electric Radiator. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Jan. 25, 1895.

598,640. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Original application filed April 6, 1895. Divided and this application filed Aug. 6, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

598,610. Coin-Controlled Telephone Pay-Station. William Gray, Hartford, Conn., assignor to the Gray Automatic Telephone Pay Station Company, same place. Filed Dec. 4, 1895.

598,833. Electric Call-Box System. William T. Budds, Charleston, S. C. Filed Aug. 23, 1897.

MISCELLANEOUS.

598,498. Junction Box for Electric Conductors. Thomas J. Close, Philadelphia, Pa. Filed May 26, 1897.

598,508. Automatic Electric Fire-Alarm. William A. Guthrie, Durham, N. C. Filed July 7, 1897.

598,566. Primary-Battery Cell. Fred H. Brown, Chicago, Ill. Filed Dec. 9, 1895. Renewed Jan. 12, 1898.

The Minnesota Central Telephone Company has sent a communication to the city council of St. Paul, asking for a franchise to supply telephone service in that city. The communication, which was referred to the committee on streets, stated that the Minnesota Central Telephone Company is one of four comprising the Western Electric Telephone system; that it has about three thousand miles of toll lines in operation, particularly in Southern Minnesota and Northern Iowa, extending into South Dakota, with branches in Wisconsin. The stockholders, the communication adds, are business men of the towns reached by the company's lines. Minneapolis, it is stated, granted the company a franchise on January 28, and it stands ready at an early date, as soon as it gets a franchise, to give St. Paul as good service as Minneapolis will get. The lines of the company are in operation at points adjacent to the Twin Cities.

At the Electrical Club's annual banquet at Boston on the evening of the 8th inst., a telephone receiver was placed at the plate of every guest, and a huge megaphone was suspended from the ceiling. Direct wires had been established between the central offices in New York and Chicago and the central office in Boston, and from the latter to the banquet room. By these means the speeches, jokes, applause, etc., of the banqueters were communicated instantaneously to numbers of friends assembled for the purpose in the cities named, and these in turn were enabled to contribute by their happy sallies to the interest of the occasion. When picture telephony is perfected, the enjoyment of all such gatherings will be doubly enhanced by seeing their friends as well as hearing their voices.

Telephone manufacturers in Chicago propose to wage a vigorous warfare against a bill now before the Legislature which provides that after making a statement to the Auditor the person or corporation making the same shall pay a tax of \$10 for each telephone connection and the further sum of \$50 for each telephone connection with a device known as a telephone slot arrangement. As explained by Vice-President W. A. Bisland of the Western Telephone Construction Company, "this seems to be the Bell method of fighting the cheaper rates that are in vogue among the independent companies now giving towns and farming districts in Illinois good service. The measure will not hurt the Bell Company as much as the independent companies for the reason that the older corporation feels itself well entrenched by the occupancy of the field in the larger cities."

Mr. Jenkins has introduced a bill in the House of Representatives providing that "whereas it is represented to this present Congress that the Automatic Telephone Exchange Company (limited) of Washington and London, England, a corporation duly organized and operating under and by virtue of the general laws of the State of West Virginia, is desirous of establishing its system of telephony within the District of Columbia, and that in consideration of its being permitted so to do, it will supply a much superior service to that now in use in the District of Columbia, and at less than one half the rates now being charged," the company be authorized to lay conduits in Washington and proceed to conduct a telephone business.

The Owosso Telephone Company has closed a contract with the New State Telephone Company to furnish equipments for an exchange at Owosso, Mich. There will be 150 'phones to start with, though the switchboard will accommodate twice that number. The copper metallic toll line of the New State Company will be extended from Fenton to Owosso, and the exchange will be in operation by the middle of April.

Judge Toulmin of the United States District Court at Mobile, Ala., has handed down an opinion in the case in equity of the Western Electric Company, Chicago, vs. the Home Telephone Company, Mobile, for infringement. A decree will be entered on two claims of claimants, and an accounting of profits and damage in respect to these claims is ordered. The injunction is not to be operative until 60 days after entry of the decree on account of public inconvenience.

The new telephone company at Indianapolis is busy placing its plans before members of the city council so that the latter may be fully informed of the intentions of the company when application for a franchise is made. There is some talk of reviving the Citizens' Co-operative Telephone Company, which was granted a franchise several years ago but afterwards became involved in lawsuits and retired from the field.

An ordinance has been submitted to the Parkersburg, W. Va., council granting a franchise to the Home Telephone Company. The ordinance provides that the company shall begin the construction of its telephone system within one year from the date of passage of ordinance, and that a rate of not over \$24 per year shall be charged for the use of the 'phones by subscribers. The company is

composed of F. H. Yost, H. S. Yost, P. W. Yost and G. S. Basnett.

The Newark (N. J.) Telephone Company has re-elected these officers: President, John M. Gwinnett; secretary, James F. Connelly; treasurer, Samuel Klotz; directors: John M. Gwinnett, Timothy W. Lord, George W. Wiedenmayer, Charles B. Smith, Samuel Klotz, Bernard Straus, Theodore C. E. Blanchard, James F. Connelly, P. J. Nevins, Henry Vincent Jackson, L. Eugene Hollister.

The manufacturing property of the Best Telephone Company is advertised by the receivers to be sold at auction in Baltimore, Md., on the 17th inst. A catalogue of the articles to be disposed of contains 28 pages and includes the patents and certificates of stock owned by the company as well as the machinery, plant, electrical and telephone apparatus, office furniture, etc.

The borough council of Bellefonte, Pa., has granted a franchise to the Millheim Telephone Company to erect poles and wires and establish an exchange in the town. The Millheim Company was organized a year ago and lately extended its service to Bellefonte and through Union, Snyder and adjoining counties. The Bell Company has now arranged to extend its service all over the territory covered by the Millheim Company.

A dispatch from Macon, Ga., to the Atlanta Journal states that there is some talk of a new telephone company for Macon in opposition to the Bell company, and the report that the ground is being surveyed with that end in view is borne out by the fact that application has been made to the council for information on the subject of the ordinances affecting telephone companies in the city.

The certificate of the consent of two-thirds of the stockholders of the Ossining Home Telephone Company of the village of Sing Sing, N. Y., to mortgage its plant and franchises for \$25,000, the amount being less than two-thirds of the value of the plant and franchises, has been filed in the county clerk's office at White Plains.

At the annual meeting of the Saratoga, Adirondack and Lake George Telegraph Company, held at Saratoga, N. Y., the following officers were elected: President, W. West Durant, New York City; vice-president, H. G. Young, Albany; secretary and treasurer, J. W. Burdick, Albany; general manager, W. C. Humstone, New York City.

A correspondent of the Charleston News and Courier states that the telephone manufacturing company at Sumter, S. C., has recently enlarged its plant and is overrun with work. The correspondent says he saw shipments going to New York, New Orleans, Knoxville, Vicksburg and Durham, N. C.

Steps have been taken at Mankato, Minn., to organize an independent telephone company to be known as the Mankato Citizens' Telephone Exchange Company. Articles of incorporation will be prepared at once.

A company has been organized at Versailles, Ky., to erect a telephone system there. The incorporators are W. R. Procter, Breck B. Smith and Charles R. Powell.

New Companies Incorporated.

The Creswell Telephone Company, Creswell, Md. Capital stock, \$1,200. Directors: Joseph B. Hanway, Harry P. Strasbaugh, Christian Smith, John McKee, Willard G. Rouse, Joseph F. Callahan, George F. Burkley, Joseph Gorrell and Frank W. Kimble.

The Livingston County Telephone Company, Pontiac, Ill. Capital stock, \$65,000. Incorporators: W. E. Herrou, John S. Murphy and A. M. Legg.

The Fulton Telephone Company, Fulton, Oswego County, N. Y. Capital stock, \$15,000. Directors: L. nox Smith and J. P. Whitaker, New York City; George C. Webb, J. C. Curtis, Francis Stiles and F. A. Sage, Fulton.

The Moore Telephone Manufacturing Company has filed articles of incorporation at Trenton, N. J. It has a capital stock of \$50,000, of which \$14,800 is paid in.

The Clifton Forge Mutual Telephone Exchange, Clifton Forge, Va. Capital stock, \$5,000. Incorporators: William Patrick, president; N. O. Watts, treasurer; J. A. Sproul, secretary and general manager.

The Toccoa Telephone Company, Toccoa, Ga.—to construct and operate a telephone system. Capital stock, \$5,000. Incorporators: John McJunkin, C. H. Dance, L. P. Cook and others.

The Coles County Telephone Company, Mattoon, Ill., has certified to an increase in capital stock from \$12,000 to \$35,000.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

Capital Stock.								Rate and Date of Last Div.		Bld.		Capital Stock.								Rate and Date of Last Div.		Bld.		Asked.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
NAME.	Par	Authorz'd	Issued.									NAME.	Par	Authorz'd	Issued.									NAME.	Par	Authorz'd	Issued.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

* Unlisted. † Ex div.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h \$80 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$250,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$225,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. Adams & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 5 %.
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Metropolitan Street Railway from April 20, 1892; 6 % first 5 years, 8 % thereafter.
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Controlled by Third Avenue Railroad by purchase.
 m Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.
 n Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.
 o Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
 p Leased to Fort Pitt Traction Company for 8 % on \$8,000,000 capital stock.
 q Leased to Consolidated Traction Company for 4 % on capital stock after October, 1897.
 r Leased to Consolidated Traction Company for 7 % on capital stock after October, 1897.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

CAPITAL STOCK.							CAPITAL STOCK.						
NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Feb. 14:							Boston, Mass.—Feb. 14:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2 % Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2 % Q., Oct., '97	269	270
Northampton, Mass.—Feb. 14:							Erie Telegraph & Telephone Co.....						
Northampton Street Ry.....	100	800,000	225,000	5 % A., July, '97.	165	175	New England Telephone Co.....	100	10,894,600	10,804,600	1 1/2 % Q., Aug., '97.	70	101 1/2
Omaha, Neb.—Feb. 7:							New York.—Feb. 14:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2 % Q.	91 1/2	..
Paterson, N. J.—Feb. 14:							*Central & South Am. Teleg. Co.....						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	83	85	*Commercial Cable Co.....	100	6,500,000	6,500,000	1 1/2 % Q.	105	106
Providence, R. I.—Feb. 14:							Franklin Teleg. Co.....						
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	60	65	Erie Telegraph & Telephone Co.....	100	1,000,000	1,000,000	1 1/2 % S.	40	44
Philadelphia.—Feb. 14:							*Gold & Stock Tel. Co. guar. 6 %						
Fairmount Park Trans. Co.....	50	2,000,000	2,000,000	.....	14 1/2	..	*International Ocean Tel. Co. guar. 6 %	100	5,070,000	4,800,000	1 1/2 % Q., Aug., '97.	71	71 1/2
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2 1/2 % July 15, '97.	44	45	Mexican Telephone Co.....	100	5,000,000	.....	1 1/2 % Q.	107 1/2	110
Hestonville, Man. & Fairmount.....	50	533,900	533,900	3 % S.—July 15, '97.	61	65	*New York & New Jersey Tel. Co.	100	2,000,000	.....	.....	60	70
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '97.	63	66	*Pacific & Atlantic Teleg. guar. 4 %	25	2,000,000	.....	2 % S.	71	76
Union Traction Co.....	50	30,000,000	5,986,095	.....	167 1/2	17	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 % Q.	90	95
eElectric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5 %	25	950,000	559,525	2 % S.	90	95
dCitizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	300	...	*Commercial Union Telegraph Co.....	25	500,000	500,000	3 % S., July 1 '97.	117	119
eFrankford & Southwark Pass. R.	50	1,000,000	1,187,000	\$14 share A.—Apr. 97	87 1/2	...	Western Union Telegraph Co.....	...	97,870,000	1 1/2 % Q., Oct., '97.	91 1/2	91 1/2	
fLehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	40	...	Miscellaneous.—Feb. 14:						
gLombard & South Street Ry.....	25	1,000,000	.....	A. & O.	89	90 1/2	American Dist. Teleg. (Phila.).....	25	400,000	.....	.....	14	...
hSecond & Third Streets Ry.....	50	1,060,000	771,076	\$9 share A. Mar. 97	260	...	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2 % S.	174 1/2	175
iPeople's Traction Co.....	50	10,000,000	760,000	3 % A., April, '97.	...	...	Chesapeake & Potomac Teleg. Co.	100	.....	.....	.....	61	65
jGermantown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1897.	132	...	Chicago Telephone Co.....	100	.....	.....	.....	202	...
kGreen & Coates Passenger Ry.	50	500,000	150,000	3 % July, 1897.	132	...	Central Dist. Frig. & Tel. Co. (Fgh.)	100	750,000	750,000	.....	...	...
lPeople's Passenger Ry.....	25	1,500,000	740,000	.....	...	...	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1 % Q.	12	78
mPeople's Passenger Ry.....	50	750,000	277,402	.....	...	...	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1 % Q.	65	66
nPhiladelphia Traction Co.....	50	30,000,000	120,000,000	4 % S.—Apr. 1, '97.	85 1/2	85 1/2	*Northwestern Telephone Co. guar.	50	2,500,000	2,500,000	2 % Q.	112	115
oCatherine & Bainbridge St.....	50	1,000,000	400,000	6 % A.—Mar., '97.	185	145	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	87 1/2	...
pContinental Pass. Ry. guar.	50	1,000,000	580,000	\$6 share—July, '97.	185	145	Southern New Eng. Teleph. Co.....	100	8,000,000	.....	.....	120	122
qEmpire Passenger Ry. Co.....	50	600,000	600,000	.....	...	...	ELECTRIC LIGHT AND ELECTRICAL MFG. COS.						
rPhiladelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180	Boston, Mass.—Feb. 14:						
sPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	\$3.50 share July '97	87	...	Fort Wayne Electric Co.....	25	.....	.....	.....	...	...
tRidge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share July '97	262	...	Port Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	...	...
uPhiladelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	...	...	General Electric Co.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	86 1/2	86 1/2
v17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	250,000	1 1/2 % S., July, '97.	157 1/2	...	General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90
wThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000	\$11 sh. A., July, '97	253	...	General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90
xUnion Passenger Ry. Co.....	50	1,500,000	1,000,000	\$9.50 sh. A., July '97	225	226	T.-H. Elec. Co. T. Secur., Series D.	50	.....	146,700	.....	8 1/2	8 1/2
yWest Philadelphia Pass. Ry.....	50	750,000	750,000	\$10 share, July '97	225	235	Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	3,996,068	1 1/2 % Q., Oct., '97.	54 1/2	54 1/2
Rochester, N. Y.—Feb. 14:							Westinghouse El. & Mfg. Co. assent.						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16 1/2	18	50	11,000,000	8,196,125	.....	...	...	...
Reading, Pa.—Feb. 14:							New York.—Feb. 14:						
Reading Traction Co.....	...	1,000,000	1,000,000	Semi-an., Jan. & Jy	10	15	Edison Elec. Ill'g Co., New York.....	100	10,000,000	7,988,000	.....	184	185
kCity Passenger Ry.....	50	850,000	850,000	July, '97.	111	...	*Edison Elec. Ill'g Co., Brooklyn.....	100	4,000,000	3,750,000	1 1/2 % Q., Oct., '97.	109	111
lEast Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	60	...	Edison Ore Milling Co.....	100	.....	.....	.....	...	...
St. Louis Mo.—Feb. 14:							Edison Electric Storage Co.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...	General Electric Co.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	86 1/2	86 1/2
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec., 1888.	...	...	General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 % July, '97.	124	126	Interior Conduit & Insulation Co.....	100	1,000,000	1,000,000	.....	41	...
National Railway Co.....	100	2,500,000	2,479,000	1 1/2 % July, '97.	...	...	United Elec. Lt. & Pow. Co.....	100	.....	.....	.....	...	...
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000	.....	...	...	Pittsburg, Pa.—Feb. 14:						
Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct., '98.	90	110	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	...
St. Louis RR.....	100	2,000,000	2,000,000	2 % July, '97.	95	105	East End Electric Light Co.....	50	800,000	800,000	Q	...	10
Missouri RR.....	100	2,400,000	2,800,000	1 1/2 % July, '97.	170	172 1/2	Philadelphia, Pa.—Feb. 14:						
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	...	...	Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	...
Southern Electric Ry.....	50	500,000	500,000	.....	50	52 1/2	*Electric Storage Battery Co.....	100	8,500,000	.....	.....	23	24
Southern Electric Ry.....	100	1,000,000	1,000,000	3 % S., Jan., '96.	100	102 1/2	*Electric Storage Battery Co.....	100	5,000,000	.....	.....	22	27 1/2
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	51	53	*Penna. Ht., Lt. & Pow. Co.....	50	5,000,000	.....	50c. p. sh., Oct. '97.	22 1/2	22 1/2
Union Depot RR.....	100	4,000,000	4,000,000	3 % A., July, '96.	...	175	*Penna. Ht., Lt. & Pow. Co.....	50	5,000,000	.....	6 % Oct., '97.	58 1/2	59
San Francisco, Cal.—Feb.							Northern Elec. Light & Power Co.....						
California St. Cable Ry.....	100	1,000,000	600,000	50c. monthly.	108	109	10	6,500,000	550,000	\$2500 dis. Jan. 11 '97	18 1/2	18	...
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	Southern Elec. Light & Power Co.....	10	187,500	187,500	.....	...	...
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	53 1/2	...	Miscellaneous.—Feb. 14:						
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	7	...	Brush Electric Co.....	50	.....	.....	.....	...	...
Scranton, Pa.—Feb. 14:							Bridgeport (Conn.) Elec. Lt. Co.....						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	9 1/2	11	25	800,000	.....	.....	.....	82 1/2	85
mScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	15	18	Edison Ill. Co. (St. Louis).....	25	.....	.....	.....	...	15
nScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11	Eddy Electric Mfg. Co.....	25	.....	.....	.....	118	125
Springfield Ill.—Feb. 14:							Hartford (Conn.) Elec. Light Co.....						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11	100	850,000	.....	.....	.....	4 1/2	10
Springfield O.—Feb. 14:							Hartford (Conn.) Lt. & Power Co.....						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2	25	175,000	.....	.....	.....	148	...
Springfield, Mass.—Feb. 14:							New Haven (Conn.) Elec. Lt. Co.....						
Springfield Street Ry.....	100	1,200,000	1,000,000	8 % A.	205	210	100	100,000	.....	.....	.....	82 1/2	85
Toronto Canada.—Feb. 14:							Narragansett (Prov., R.I.) Elec. Co.						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	101 1/2	102	50	1,200,000	.....	2 % Q., Oct., '96.	114	118	
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	253 1/2	256 1/2	Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	186	186 1/2
Washington, D. C.—Feb. 14:							Royal Elec. Co. (Montreal).....						
Belt Ry. Co.....	50	500,000	500,000	.....	...	...	100	1,000,000	.....	2 % Q.	186 1/2	187	
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	70 1/2	70 3/4	Toronto (Canada) Elec. Light Co.....	100	1,085,000	1,085,000	1 1/2 % Q.	90	100
Columbia Ry. Co.....	50	400,000	400,000	5 1/2 % A.	68	70	Thomson-Houston Welding Co.....	100	.....	.....	3 % S., Dec. 1, '96.	...	...
Rockington & Soldiers' Home Ry.	50	707,000	652,000	.....	...	...	Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	...	...
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	...	...	ALLIED INDUSTRIES.						
Metropolitan RR. Co.....	50	1,000,000	487,180	2 1/2 % Q.	121	...	Boston Mass.—Feb. 14:						
Worcester, Mass.—Feb. 14:							American Electric Heating Co.....						
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	15	17	50	10,000,000	.....	.....	.....	.05	.07
*Worcester Traction Co.....	100	2,000,000	2,000,000	3 % S., Sept., '97.	94	97	Street Ry. & Ill'g Properties... pfd	100	4,500,000	1,248,700	\$8 per sh. Feb. 1, '97	80	85
Worcester & Suburban Street Ry.	100	550,000	542,500	4 %, 1896.	85	...	United Electric Securities Co.....	100	.....	.....	3 1/2 % Feb., '96.	...	...
Wilkesbarre, Pa.—Feb. 14:							New York.—Feb. 14:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 %, Jan., '97.	24	29	Consolidated Electric Storage Co...	...	.....	.....	.....	...	...
							Edison European.....						
							Safety Car Heating & Lighting Co...						
							Worthington Pump Co.....						
							Worthington Pump Co.....						
							Philadelphia, Pa.—Feb. 14:						
							Acetylene L. H. & P. Co.....						
							Electro Pneumatic Trans. Co.....						
							United Gas Improvement Co. scrip.						
							Welsbach Commercial Co.....						
							Welsbach Commercial Co.....						

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to United Traction Co. at a rental of \$10,000 per an. in 1866-7-8, \$20,000 p. a., in 1875-1900, and \$50,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10 % guaranteed by Reading Traction Company.
 n Dividend of 6 % guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Feb. 14:												
Fort Wayne Electric Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ft. Wayne Elec Co. T. Sec. Series A.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	86 1/4	86 1/4	.....	.....	.....	.....	.....	.....
General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90	.....	.....	.....	.....	.....	.....
General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90	.....	.....	.....	.....	.....	.....
T.-H. Elec. Co. T. Secur., Series D.	50	.....	146,700	.....	24	24 1/2	.....	.....	.....	.....	.....	.....
Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	2,998,058	1 1/2 % Q., Oct., '97.	54 1/2	54 1/2	.....	.....	.....	.....	.....	.....
Westinghouse El. & Mfg. Co. pfd.	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Westinghouse El. & Mfg. Co. asst.	50	11,000,000	8,195,126	.....	.....	.....	.....	.....	.....	.....	.....	.....
New York.—Feb. 14:												
Edison Elec. Ill'g Co., New York...	100	10,000,000	7,988,000	.....	184	185	.....	.....	.....	.....	.....	.....
*Edison Elec. Ill'g Co., Brooklyn...	100	4,000,000	2,750,000	1 1/2 % Oct., '97.	109	111	.....	.....	.....	.....	.....	.....
Edison Ore Milling Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Edison Electric Storage Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
General Electric Co.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	86 1/4	86 1/4	.....	.....	.....	.....	.....	.....
General Electric Co.....	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	90	90	.....	.....	.....	.....	.....	.....
Interior Cond. & Insulation Co...	100	1,000,000	1,000,000	.....	41	41	.....	.....	.....	.....	.....	.....
United Elec. Lt. & Pow. Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg, Pa.—Feb. 14:												
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	107	.....	.....	.....	.....	.....	.....
East End Electric Light Co.....	50	800,000	800,000	Q	..	10	.....	.....	.....	.....	.....	.....
Philadelphia, Pa.—Feb. 14:												
Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	144 1/2	.....	.....	.....	.....	.....	.....
*Electric Storage Battery Co.....	100	8,800,000	.....	.....	23	24	.....	.....	.....	.....	.....	.....
*Electric Storage Battery Co.....	100	5,000,000	.....	.....	29	27 1/2	.....	.....	.....	.....	.....	.....
*Penna. Ht., Lt. & Pow. Co.....	50	5,000,000	.....	.....	22 1/2	22 1/2	.....	.....	.....	.....	.....	.....
*Penna. Ht., Lt. & Pow. Co.....	50	5,000,000	.....	50c. p. sh., Oct. '97.	58 1/2	59	.....	.....	.....	.....	.....	.....
Northern Elec. Light & Power Co..	10	5,000,000	.....	6 % Oct., '97.	18 1/2	18 1/2	.....	.....	.....	.....	.....	.....
Northern Elec. Light & Power Co..	10	5,000,000	550,000	\$32500 dis. Jan. 11 '97	10	10	.....	.....	.....	.....	.....	.....
Southern Elec. Light & Power Co..	10	187,500	187,500	.....	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous.—Feb. 14:												
Brush Electric Co.....	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	.....	82 1/2	83	.....	.....	.....	.....	.....	.....
Edison Ill'g. Co. (St. Louis).....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eddy Electric Mfg. Co.....	25	.....	.....	.....	.....	15	.....	.....	.....	.....	.....	.....
Hartford (Conn.) Elec. Light Co....	100	.....	.....	.....	118	128	.....	.....	.....	.....	.....	.....
Hartford (Conn.) Lt. & Power Co....	100	850,000	.....	.....	4 1/2	10	.....	.....	.....	.....	.....	.....
New Haven (Conn.) Elec. Lt. Co....	25	175,000	.....	.....	148	.....	.....	.....	.....	.....	.....	.....
Narragansett (Prov., R.I.) Elec. Co.	100	100,000	.....	.....	82	85	.....	.....	.....	.....	.....	.....
Rhode Island Elec. Protec. Co.....	50	1,200,000	.....	2 % Q., Oct., '96.	114	118	.....	.....	.....	.....	.....	.....
Royal Elec. Co. (Montreal).....	100	.....	.....	.....	156	156 1/2	.....	.....	.....	.....	.....	.....
Toronto (Canada) Elec. Light Co....	100	1,000,000	.....	2 % Q	187	187	.....	.....	.....	.....	.....	.....
Thomson-Houston Welding Co.....	100	1,068,000	1,068,000	1 1/2 % Q	187	187	.....	.....	.....	.....	.....	.....
Woonsocket (R. I.) Electric Co.....	100	.....	.....	3 % S., Dec. 1, '96.	90	100	.....	.....	.....	.....	.....	.....

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.		Amount.		Due	Interest periods.	Bid.	Asked.	NAME.		Amount.		Due	Interest periods.	Bid.	Asked.
Authorized.	Issued.	Authorized.	Issued.												
Albany, N. Y.								New Orleans La.							
Date of Quotation—Feb. 14, 1898.								Date of Quotation—Feb. 7, 1898.							
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....	.....	New Orleans City RR. 1st mtg. 6s.	5,000,000	3,000,000	1943	J. & J.	72½	.....
Waterfront Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....	.....	N. Orleans City & Lake RR. 1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	110
Waterfront Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	.....	N. Orleans City & Lake RR. 2d mtg. 6s.	5,000,000	2,599,500	1943	J. & J.	96	97½
Troy City Railway Co. 1st mtg. 5s.	.....	.....	.....	.....	*103½	106½	.....	Orleans Railroad Co. Cons. mtg. 6s.	850,000	800,000	1907	F. & A.	108	.....
†Interest guar. by Albany Ry. Co. †Principal and interest guar. by Albany Ry. Co.								St. Charles St. RR. Co. 1st mtg. 6s.	800,000	800,000	1912	J. & J.	91½	99	
								St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	103	.....
								†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. †\$90,000 outstanding.							
Baltimore Md.								New York.							
Date of Quotation—Feb. 14, 1898.								Date of Quotation—Feb. 14, 1898.							
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	.....	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	.....	Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	108	110
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	105	107	.....	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	*105	106
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	116	.....	.....	Brooklyn & 7th Ave. 1st cons. mtg. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	112	.....	.....	Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105½	108
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	112	.....	.....	Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116	.....	Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	.....
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	.....	.....	Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	*107	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119¾	121	.....	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
†\$151,000 in escrow to retire 1st mtg. bds.								Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115	
								Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	90	
								Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	.....
								Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	107	108	
								Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	.....	80
								Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	95½	.....
								Bleeker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	105	.....
								Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115	
								Central Crostown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122	
								Coney Island & Brooklyn RR. 1st mtg. 6s.	300,000	300,000	1903	J. & J.	104	105	
								D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	115	117	
								Dry Dock, E. Bd'y & Bat'y R. scrip 5 %	1,100,000	1,100,000	1914	F. & A.	97	*101	
								Eighth Av. RR. Co. Cert. indebt. 6 %	1,000,000	1,000,000	1914	F. & A.	100	.....
								42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	118	
								42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96	
								Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	.....
								Metropolitan St. Ry. Co. g. m. el. tr. g. 5s.	12,500,000	1,500,000	1937	F. & A.	114½	.....
								Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110	
								Second Avenue Ry. Deb. 5s.	800,000	800,000	1909	J. & J.	101	105	
								Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117	
								South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	102	107
								Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125	
								Twenty-third Street Ry. 1st mtg. 6s.	150,000	150,000	1909	J. & J.	.....	.....
								Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108	
								Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106	
								Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105	
								†\$1,035,000 in escrow to retire gen. mtg. bonds.							
								†\$4,850,000 in escrow to retire maturing obligations.							
								†\$552,000 in escrow to retire 1st and 2d mtg. bonds.							
								†In treasury, \$80,000.							
								†Guar. by Union Ry. Co.							
								Toronto Canada.							
								Date of Quotation—Feb. 14, 1898.							
								Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	.....	.....
								†Toronto St. Ry. 1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	.....	.....
								†\$35,000 per m. single track authorized. †\$600,000 in escrow to retire 6s due in 1901.							
								Philadelphia.							
								Date of Quotation—Feb. 14, 1898.							
								Continental Pass. Ry. 1st mtg. 6s.	350,000	310,000	1909	J. & J.	.....	.....
								Empire Pass. Ry. 1st mtg. 7s.	300,000	200,000	1900	J. & J.	.....	.....
								Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....
								Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	.....	1901	.....	.....	.....
								People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
								People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....
								People's Pass. Ry. Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	.....	.....
								People's Pass. Ry. Stk. frs. cert. g. 4s.	5,698,210	.....	1943	.....	102	.....
								Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....
								Philadelphia Trac. Co. Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105	
								Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1903	A. & O.	.....	.....
								Union Passenger Ry. 1st mtg. 7s.	500,000	500,000	1941	A. & O.	.....	.....
								Union Traction Co. Coll. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	.....	.....
								West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....
								West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115½	.....
								West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114½	115	
								†The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.							
								Pittsburg, Pa.							
								Date of Quotation—Feb. 14, 1898.							
								Birmingham, Knox & Allentown. 6s.	500,000	500,060	1931	M. & S.	.....	95
								Central Traction Co. 1st mtg. 5s.	375,000	375,000	1930	J. & J.	.....	.....
								Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	.....
								*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	110	.....
								*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1913	J. & J.	.....	.....
								*Fed'l St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	107½	.....
								Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1923	M. & N.	106½	107½	
								Pittsburg, Crafton & Mansfield. 5s.	250,000	250,000	1924	J. & J.	105	.....
								Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	.....
								Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	104½	105	
								Pittsburg & West End. 1st mtg. 5s.	500,000	500,000	1922	J. & J.	.....	.....
								*Pg'h., Allegh. & Manch. Gen. mtg. 5s.	1,500,000	1,400,000	1890	A. & O.	.....	114
								Second Ave. Traction Co. 5s.	2,500,000	2,000,000	1934	J. & D.	.....	.....
								Sub. Rapid Transit Railway Co. 6s.	500,000	500,000	1913	M. & S.	.....	.....
								Providence R. I.							
								Date of Quotation—Feb. 14, 1898.							
								Newport Street Ry. Coupon 5s	50,000	50,000	1910	J. & D.	.....	.....
								United Trac. & Elec. Co. 1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	106	107	
								St. Louis.							
								Date of Quotation—Feb. 14, 1898.							
								†Baden & St. Louis RR. 1st mtg. 5s.	250,000	250,000	1913	J. & J.	100	102	
								Cass Ave. & Fair Gds. Ry. 1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102½	103½	
								Citizens' Railway Co. 1st mtg. 6s.	2,000,000	1,800,000	1907	J. & J.	107½	108½	
								*Comp. Hts., Un. Ds. & Mer. Ter. 1st 5s	1,000,000	1,000,000	1913	J. & J.	110½	112½	
								*With interest. Unlisted.							

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Feb. 14, 1898.						
Fourth St. & Arsenal St. Ry., 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry., 1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co., 1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	106½	107½
Missouri RR. Co., 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co., 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co., 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co., 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co., Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric, 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co., 1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry., 1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry., Income 5s.	800,000	800,000	.....	.....	60	64
St. Southern Electric Ry., Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry., 1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	111	112
Union Depot RR. Co., 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co., Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113½	114½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$800,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Feb., 1898.						
California St. Cable RR., 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry., 1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	....
Geary St., Park & Ocean RR., 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	102	102½
Market St. Cable Ry. Co., 1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	128	129½
†Metropolitan Ry. Co., 1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co., 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
†Park & Cliff House RR., 1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	109½
†Park & Ocean RR., 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry., 1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
†Sutter St. Ry. Co., 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Feb. 11, 1898.						
Belt Ry. Co., 1st mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry., 1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home, 1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co., Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Feb. 11, 1898.						
Bridgeport Traction Co., 1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co., Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	111	112
†Citizens' St. R. (Ind. pols), 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
†Crosstown St. Ry. (Buffalo), 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	108½	109½
†Columbus (O.) St. Ry., 1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95½	98
Consolidated Traction (N. J.), 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	103
†Crosst'n St. Ry. (Colu's, O.), 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	95	98
Denver City Cable Ry., 1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	93	97
Denver Con. Tram'y Co., Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	93	97
Louisville (Ky.) Ry., 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	113	113½
†Minneapolis St. Ry., 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	92	94
†No. Hudson Co. Ry. (N. J.), Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.), 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.), Deb. 6s.	500,000	439,000	1902	F. & A.	118	.....
Paterson (N. J.) Ry., Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Rochester (N. Y.) Ry., 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	98	99
St. Paul City Ry., Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry., Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of D. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
††\$620,000 in escrow.						

*With 1st rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Feb. 14, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	.....	Quar.	154	....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	100½	....
Pittsburg, Pa.						
Date of Quotation—Feb. 14, 1898.						
Allegheny County Light Co., 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light, 1st mtg. 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co., Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Feb. 14, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	111	....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,176,000	1993	.....	113	.....
Edison Elec. Ilig. Co. (Brooklyn), g. 5s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia), g. 5s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis), 1st mtg. 6s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis), 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis), 2d mtg. 6s.	600,000	.....	1921	Q. ry.	.....	.....
United Elec. Light & Power Co. (N. Y.), g. 5s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Feb. 14, 1898.						
American Bell Telephone, 7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co., 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co., 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Feb. 14, 1898.						
American Electric Heating, 5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co., 10s.	.....	.....	.....	.....	25	.....
*Barney & Smith Car Co., 10s.	.....	.....	1942	J. & J.	96	100
Carborandum Mfg. Co., 10s.	.....	.....	1904	M. & S.	.....	.....
Warrington Pump Co., 10s.	75,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10½@10½c.; Lake, 10½@11c.; cast ing, 10½@12c.

The Electric Railway Equipment Company of Washington, D. C., of which A. C. Greenlee is president, has been granted a charter. The capital stock is \$100,000.

The Jones Brothers Electric Company, Cincinnati, has increased its capital stock from \$200,000 to \$220,000.

The Welsbach Commercial Company, Philadelphia, has declared its usual 2 per cent. quarterly dividend, payable March 10.

Owosso & Corunna Electric Company is the name of a new corporation organized at Owosso, Mich. Its capital stock is \$150,000.

Application has been made to the New York Stock Exchange to list Twin City Rapid Transit Company \$577,000 additional cumulative 7 per cent. stock.

The Chicago City Railway Transit Company has been organized at Chicago to build and operate an elevated railway line. The capital stock is \$1,000,000.

The Philadelphia "Times" states that "the local electric light consolidation plan, it is said, will not interfere with the April interest and dividends on Pennsylvania Heat, Light & Power stocks."

L. F. Hyde and Charles S. Baxter of the law firm of Hyde & Baxter, Boston, have taken charge of the claims department of the Boston Elevated Railway Company, vice W. B. Sprout, resigned. Last year the West End Street Railway Company paid out \$470,000 in settlement of claims.

The stockholders of the Citizens' Electric Light & Power Company of St. Louis have voted to issue bonds to the amount of \$2,000,000. This action was taken pursuant to a call issued January 28, at which time the company voted to increase its capital stock from \$750,000 to \$2,000,000.

A distribution of \$3 per share was made on the 12th inst. upon common stock of Street Railway & Illuminating Properties, Boston, to stock of record at the close of business February 8. This is the first dividend on the common stock. Future dividends are expected at irregular intervals.

There will be a meeting of the stockholders of the Metropolitan Street Railway Company in New York on March 4 to authorize the lease of the Second Avenue Railroad. The stockholders of the latter company will also meet that day and authorize the lease of their line to the Metropolitan.

It is announced that the Metropolitan Street Railway, New York, will shortly issue \$10,000,000 of additional stock, increasing its share capital from \$30,000,000 to \$40,000,000. Each stockholder will be permitted to subscribe for one share of new stock for every three shares now held. The stock will be issued at par, thus raising \$10,000,000.

It is reported that a syndicate of New York capitalists are endeavoring to secure control of the Dolgeville Electric Light & Power Company and of the Little Falls Electric Light & Power Company. The Dolgeville company has just completed a large electricity generating plant at the manufacturing village of Dolgeville, N. Y., and is supplying the Little Falls company with current for its service.

The Raleigh, N. C., "Post" of the 8th inst. says: "The Southern Bell Telephone Company have filed with the Railroad Commission their \$5,000 bond. It is given by the United States Fidelity & Guarantee Company. The Commission ordered a reduction of telephone rental rates to go into effect February 1, and afterwards granted the companies another hearing February 17. The Commission then allowed the companies, if they filed this bond to protect the telephone users, not to put the new rates into effect until after the final decision February 17."

The various street railway lines in Dallas, Tex., recently acquired by C. H. Alexander and E. A. Ellis, have been reorganized under a new charter and capitalized at \$1,000,000. The new name is the Dallas Consolidated & Electric Street Railway Company. C. H. Alexander is president and general manager and Emmette A. Ellis is treasurer. Messrs. Ellis and Alexander have filed deeds conveying their interests in the lines to the new company.

The finance committee of the Baltimore City Passenger Railway Company, to whom has been submitted the question of the manner of raising the funds necessary to pay for the stock of the Central Railway Company, will, it is understood, recommend to the directors that \$1,000,000 be raised, of which \$600,000 will be paid for the Central stock and the remaining \$400,000 used to retire the floating debt of the Baltimore City Passenger Railway Company incurred in electrifying certain of the company's lines and providing for future improvements.

The reports of the Brooklyn Heights Railroad Company and the Brooklyn Queens County & Suburban Railroad Company for the quarter ending December 31, 1897, have been sent to the State Railroad Commissioners at Albany. The gross earnings of the Brooklyn Heights Railroad Company were \$1,110,371.18, an increase of \$47,200.62 over a like period in 1896, and operating expenses \$660,277.40, an increase of \$27,479.77. The net earnings were \$450,093.78, against \$430,372.93 for the last quarter of 1896. There was a surplus of \$131,354.09 for the year. The net earnings of the Brooklyn, Queens County & Suburban were \$80,714.68 for the quarter, an increase of \$17,963.05 over a like period in 1896.

Judge Cox has decided in the Fredonia Hotel case at Washington, D. C., that the guests of a hotel have not the right to use the hotel telephone for their private business without paying for it to the company, and that if the telephone is used for hotel business by the guests a clerk of the house must use it, and not the guests. A hotel telephone is not different from a private telephone, it may be used only for the special business of the house and not by outsiders who do not pay.

The United Electric Securities Company of Boston on Monday last purchased \$6,000 of its 5th series 5 per cent. collateral trust bonds, leaving \$469,000 outstanding; lowest price was 96½, highest 102½;—\$17,000 of the 6th series, leaving outstanding \$308,000; lowest price was 99, highest 102½;—\$20,000 of the 8th series, all that were offered, leaving outstanding \$500,000; lowest price was 99½, highest 102½;—\$97,000 of the 9th series, leaving outstanding \$494,000; lowest price was 100, highest 102½.

An outline of the agreement reached between the Brunswick Traction Company of New Brunswick, N. J., and the New York & Philadelphia Company, of Philadelphia, which have been at war for the last few years over franchises, has been made public. Mr. Radel, the president of the Brunswick Company, continues in his position, and is to build lines connecting the different points in Middlesex county and thence to Raritan. The Philadelphia Company is to build in Somerset county, and connect the allied lines with Princeton and Trenton. When the system thus jointly planned is in operation there will be continuous trolley connection from Perth Amboy on the east to Trenton on the west.

Justice Wilmot, in the Supreme Court, Brooklyn, has handed down an opinion contrary to the general understanding of the Kingston decision as affecting the right of a surface railroad to operate on the tracks of another company without first obtaining the consent of a majority of the property owners. The case before the Justice was that of Kunz vs. the Brooklyn Heights Railroad Company. Kunz sought to restrain the company from constructing a curve near his property at Adams and Prospect streets to connect two lines. The Justice, in finding for the railroad company, said that section 78 of the railroad law makes it legal for any company to enter into a contract with another for the use of its lines. In referring to the Kingston decision of the Appellate Court to the opposite effect, the Justice said the opinion of that court "was merely a dictum of the Justice, as he himself clearly intimated."

ELECTRICITY.

Vol. XIV.

NEW YORK, FEBRUARY 23, 1898.

No. 7.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	97-98
Municipal vs. Private Ownership.	
Electricity as a Tunnel Illuminant.	
Valuable Papers Stolen.	
Electric Headlights.	
Under the Searchlight,	98
No Faith in the G. E. Company.	
Tungsten Steel for Magnets,	99
Obituary—J. H. Rhotshamel,	99
Polyphase Motors,	99
A New Form of Fuel,	99
Motions of Membranes Between Electrolytes,	99
The Calculations of the Electrical Resistances of Alloys and Their Application to the Finding of Alloys of Definite Electrical Properties. By C. Liebenow. (Concluded),	100
Electric Lighting for Profit. By Alex. Dow,	101
Standard System of Electrical Diagrams,	104
Electrical Tramways in Europe,	105
Electric Apparatus for Great Gull Island,	105
The Harrisburg Foundry and Machine Works,	105
Bids Wanted,	105
London Notes,	105
Telegraph Tournament at the Electrical Exhibition,	105
Meeting of the New York Electrical Society,	105
Legal Notes,	105
General News,	106
Personal and Miscellaneous.	
Recent Company Elections,	107
Commercial Paragraphs,	107
Incorporations,	107
Electrical Patent Record,	108
Telephone and Telegraph,	108
Electrical Securities—Stocks, Bonds, Etc.,	109
Notes for Investors,	112

EDITORIAL NOTES.

Municipal vs. Private Ownership.

We note with regret that two bills were recently introduced in the Assembly at Albany, one providing for municipal ownership of railroads, surface, elevated or underground, by cities of the first-class, while the second provides for municipal ownership of lighting facilities, such as gas, electric light, etc. Although the probabilities are that these two bills will never become laws, it is to be deplored that anyone should have deemed it expedient to introduce two such measures after comparing the statistics of communities having municipal ownership with those in which street railways and lighting plants are owned and operated by private corporations. Considerable has been written on this subject of late, and all the facts and figures so far obtained simply go to show that nearly every street railway or electric lighting plant operated by a municipality is a dismal failure.

Take, for example, Austria. After spending immense sums of money in building and equipping the railways they were ultimately sold for about one-half what they cost to private corporations, owing to the inability of the Government to operate them successfully.

The advocates of municipal ownership have repeatedly pointed to Glasgow as an example of what a city can accomplish in the way of successfully operating street railways. The facts of the case are that the conditions existing there differ so materially from those existing in American cities that comparisons are of little or no value. In Glasgow the street railway fare averages 1.85 cents per mile, the average trip being one mile. In most of the large cities in this country, such for instance as Brooklyn, a passenger may ride in the neighborhood of 18 miles for 5 cents or for a little less than three-tenths of a cent per mile. This is accomplished in spite of the higher wages which prevail on this side of the Atlantic. The drivers and conductors in Glasgow after two years of service are paid at the rate of \$1.04 a day, whereas the motormen and conductors in Brooklyn receive from \$2 to \$2.50 a day, other employees, such as inspectors, starters, car cleaners, etc., being likewise paid proportionally higher. It will therefore be seen that the scale of wages here, as shown in the case of Brooklyn, is about double that of Glasgow. And yet the cost of traveling per mile in our cities is much less than in the Scotch city.

As previously stated, however, comparisons between cities in Europe and those in this country are of little value, because of the vastly different environments.

Probably the best example of the municipal ownership of an electric lighting plant is that of Detroit,

Mich. The machinery and equipment cost that city in the neighborhood of \$700,000. Notwithstanding the fact, however, that exceptional conditions prevail in that locality, due to non-political management, according to their own report their light costs them \$100 per lamp per year, whereas Newark, N. J., pays a private company \$98.55 per year. Several other large cities could be named that pay less to private companies for light than it costs Detroit. Take for example Pittsburg, Pa., which pays but \$96.00 and Cleveland, O., where a lamp per year costs but \$94.80.

There is moreover another point which should be borne in mind in connection with the municipal ownership of electric lighting plants. The rate of taxation in towns of the latter class is shown to be considerably higher than in towns which do not own a lighting system. That the effort to sustain a municipal plant increases taxes is shown in the case of Humboldt, Tenn. The tax rate was \$1 on \$100 before bonds were issued, now it is \$1.50, and a special tax has to be levied besides to pay bonds. This is to be expected; the masses are taxed to make up for any loss the city may incur, and for the benefit of a comparatively small number of citizens who use private lights. If 10 per cent. is not set aside for depreciation, a community suddenly awakens to find a depreciated and run-down plant on their hands and the bonds coming due.

The great trouble is that many persons have an erroneous idea of what municipal ownership means. This is especially so among the masses of a community who are often induced to vote in favor of it through a mistaken idea that if the city becomes the owner of, say, an electric lighting plant, they will reap the benefits at no expense to themselves. The following rather humorous paragraph illustrates the idea that seems prevalent:

"Ye see 'tis this way. Th' city is goin' to own 'th sthreet railroads an' th' gas-houses 'an' th' illio-thrio lightin' plants an' all. The city'll own 'thim an' r-run thim f'r th' binift iv th' people, an' a ma'an instead iv payin' a nickel f'r ridin' in th' sthreet ca'ar to a la-ad he niver see before will thransfer th' coin fr'm wan pocket to another an' ring up wan fare f'r himsilf."

To enable comparisons to be made between electric lighting plants operated by private companies and those operated by municipalities, Mr. M. J. Francisco, in his valuable work entitled "Municipal Ownership vs. Private Corporations," has made up a complete list of cities in the United States that manufacture their own light and of those who purchase lights from an outside source. For each of these communities the cost per hour is given as well as the candle power per hour for one cent. Regarding the comparative cost of the two systems Mr. Francisco states as follows:

"An examination of the tables discloses the fact

that in nearly every case the cost per hour where contract is made with a private company is less than when furnished by the municipality; also that the candle power for one cent furnished by the private company is more than that produced by the municipal plant.

"An average of the cost by private companies, and representing every State in the United States, shows cost per hour to be .0252 cent, while they furnish on an average 654 candle power per hour for one cent. The same analysis of the municipal plants, taken from every State in which municipal plants are operated, shows that the average cost per hour is .0359 cent, while they only furnish on an average 404 candle power per hour for one cent.

"This shows that the private companies are furnishing the lights on contract on an average of .107 cent per hour less than the municipalities can produce them, and also furnishing 250 candle power per hour more for one cent than the municipal plants."

From this it will be seen that on the score of economy little can be said for municipal ownership. Statistics, moreover, show that while private corporations are gradually furnishing light at lower rates, municipalities operating their own plants are steadily increasing their rates to private consumers in order to make both ends meet. As Mr. Edward E. Higgins has stated, the best solution of the problem is probably "complete monopoly, private ownership and operation, perpetual franchises and a system of perpetual profit-sharing with the municipality, joined to a remission of charges to the public if and whenever profits come to be sufficient for that purpose."

* * *

Electricity as a Tunnel Illuminant.

The lighting of railway tunnels by electricity would seem to be rapidly coming into vogue. The Baltimore tunnel is so lighted; arrangements have, we understand, been made to light the Hoosac tunnel, and now we hear that the great St. Gothard tunnel connecting Italy with Switzerland will shortly be illuminated by means of arc lamps. There is nothing very new in the lighting of subterranean passages by electricity, as several catacombs in Rome have been lighted in this manner for some time.

The advantages claimed for an electrically-illuminated railway tunnel are many. It will presumably greatly reduce the chances of an accident happening either from collision or through a broken rail, as the engineer will be enabled to see clearly for a long distance ahead—far enough at least, if the lights are properly distributed, to stop his train in time.

With a view to reducing the cost of lighting to a minimum, it has been suggested that the illumination be made automatic. This could be accomplished by placing a switch beside the rail at the entrance of the tunnel. When a locomotive reached this point the switch would be thrown and the tunnel illuminated. By such an arrangement current would be consumed only while a train was passing through the tunnel, for on emerging from the latter another switch would automatically be thrown which would extinguish the lights. The principal argument however brought up in favor of such an arrangement is the benefit which would be derived from it as a means of signaling, for should a train approach a tunnel through which there was but a single track and the lights were burning, the engineer would know immediately that another train had already entered. In the case of a tunnel with double tracks, the lights might be placed over each track alternately, each row of lights being controlled by a switch on the track over which the lights were placed. This would enable an engineer of a train about to enter a tunnel to tell at once whether there was a train already in the tunnel on his track.

An arrangement such as this should greatly add to the safety of travel.

Valuable Papers Stolen.

The Sprague Electric Company, which occupies a suite of offices in the Commercial Cable Building, New York, announced some days ago that a number of valuable papers had been stolen from a desk in room 1509. These papers were of so much importance that the company immediately on the discovery of their disappearance offered a reward of \$1,000 for information which would lead to the arrest and conviction of the thief. Our representative called at the company's offices and was informed that the papers which have disappeared were not as has been intimated drafts of new inventions, but were comprehensive reports made by the company's engineers on the workings of lines in Chicago and other cities which have been equipped with what is known as the Sprague multiple unit system of electrical propulsion, invented by Mr. Frank J. Sprague. These reports were especially valuable to the above concern as they had been compiled at considerable trouble and great expense, in view of the possible installation of that system on railway lines in this and other cities. Our representative was informed that as far as the memoranda are concerned they can readily be duplicated. It is naturally embarrassing, however, for the company to lose them, for it is impossible to tell what use might be made of the information which they contain. It is to be hoped the thief, whoever he may be, will be apprehended and the reports recovered.

* * *

Electric Headlights.

A paper by R. C. P. Sanderson entitled "Fads, Customs and Their Cost," read at a meeting of the New York Railroad Club, attracted considerable attention owing to a paragraph which condemned electric headlights for locomotives. The passage referred to reads as follows:

"There is no longer any good purpose in putting headlights of the size of a small Saratoga trunk on the front of engines. All that is really needed is a front signal lamp of a distinctive character. There is a positive danger in using a very brilliant and powerful headlight, such as some of our electric friends are interested in, for the reflected glare off the surface of the switch lamp's lens is often so great that it entirely overpowers the light coming from the lamp, and will show apparently white light to the engineman while the signal may be standing at red or green. For safety a runner must, therefore, look for the position of a target or semaphore and not trust to the lights at night."

The above statement provoked considerable discussion and interest among a large number of railroad men, as the electric headlight was coming more and more into use and had up to that time been extremely well thought of.

With a view of ascertaining whether there was any foundation for Mr. Sanderson's statement, it was decided to make a thorough test of the electric headlight, and settle the question as to whether it prevented the color of signal lamps from being distinguishable.

The experiment was recently carried out on the Peoria and Eastern division of the Big Four Railroad. A number of section men were stationed along the line with vari-colored lanterns between Indianapolis and Brownsburg. The different colored lanterns were distinctly visible from a half mile to one and a-half miles ahead of the locomotive, the red light standing out especially clear in contrast to the pure whiteness of the electric headlight. It was also stated that the green light, which is considered the most difficult light to make out, was plainly discernible.

Contrary to Mr. Sanderson's statement, it was ascertained without a doubt that the pure white light of the electric arc magnified and strengthened the different colored lights by the contrast. This important point having now been settled so satisfac-

torily, undoubtedly many roads will follow the example set them by the Big Four and proceed to equip their locomotives with electric headlights.

Under the Searchlight.

Notes and Comments on Various Topics.

No Faith in the General Electric Company.

The *Standard* of Watertown, N. Y., says:

The Thomson-Houston International Electric Company, or the General Electric Company, as it is now called, of Schenectady, has furnished a bond of \$50,000 in the three actions brought against it by Charles Cohen, real-estate dealer and owner of the Watertown Heights, who is suing the company for \$193,000 for services and commission while he was engaged in the employ of the company in South Africa.

The cases were on the calendar for the present term of the Supreme Court. Attorney Elton R. Brown, for the company, made a motion some time ago before Justice Williams to have the cases put over the term. Justice Williams granted the motion, but required that the company furnish a bond of \$50,000 to cover a judgment Mr. Cohen secured it. This was on motion of V. K. Kellogg, attorney for Mr. Cohen, who stated that the company might go out of business any day.

The bond was received this morning by Mr. Kellogg from Hinsdill Parsons of Schenectady, who is one of the attorneys for the company. The bond is for \$50,000 and is furnished by the National Surety Company.

The italics are ours. We are pleased to see that at least a few persons are beginning to realize the actual condition of the General Electric Company and are not hoodwinked by glowing accounts of its prosperity.

* * *

WARDEN C. P. HOYT of Denver is said to have designed an electric spanking-chair for use in the Industrial School in that city. It consists of a seatless chair on which the refractory pupil is placed, and is high enough from the ground to allow of four paddles being operated, presumably by a small electric motor. The pupils who are made to go through this ordeal will probably no longer believe in the old saying that "lightning never strikes twice in the same spot."

* * *

At a small dinner given recently in a Western city, says the *New York Sun*, the guest of honor was a young married woman who is the proud mother of two handsome boys, both under 5 years of age. In their education she endeavors to follow a system, after the manner of most young mothers, and is very particular to live up to any rule she has made for them.

During an early course in the dinner, and in the middle of an animated conversation with her host, she suddenly paused with a startled look and cried:

"There, if I did not forget those boys again! Have you a telephone in the house, and may I use it?"

She was taken to the telephone by her host, and the murmur of her voice in earnest conversation floated back to the dining room. After a short pause she returned.

"I do hope you will pardon me," she said. "But you see, I always have Georgie and Eddie say their prayers for me before they go to sleep. I forgot it to-night in the hurry of getting off, so I just called up their nurse. She brought them to the 'phone, and they said their prayers over the wire, so my mind is relieved!"

* * *

The following from the *Louisville Evening Post* savors strongly of Munchausenism:

"A few years ago 'Dad' Wright of Salvisa, this State, had a very remarkable experience with lightning," said a gentleman from Garrard County, whose stock of good and true stories is always large. "His escape from instant death at the time was miraculous. While hastening on foot through an open field toward his home during a terrific thunderstorm he was struck squarely on the head by an electric bolt. It stripped the hair from one side of his brainpan, tore the clothing from his body, and made a crooked black stripe an inch wide down his left side from head to foot. When struck he bounced several feet in the

air and fell back upon the ground as if dead. The shaft entered the earth throwing up a shower of mud.

"At the time Wright carried in his hip pocket a loaded revolver. Every chamber of the weapon was discharged, the woodwork was burned and the metal partially fused by the heat. His left shoe was ripped from his foot. The unfortunate man lay senseless and naked for several hours in the drenching rain, but, incredible as it may seem, finally regained partial consciousness and began to stagger uncertainly about over the field. He was in this pitiable condition when discovered.

"He was soon recognized, taken in charge, and conducted to his home, where he was clothed and given proper attention.

"As a result of the stroke his teeth and toenails were loosened, his scalp almost denuded of hair, and his hearing permanently impaired. On the other hand he reaped an unexpected and decided benefit. For years prior to the occurrence here outlined he had been a great sufferer from muscular rheumatism, but never afterwards felt a twinge of pain from that disease, being completely cured of it by the terrible shock.

"The dark zigzag streak along the left side of his body, indicating the scarred path of the electric current, could never be altogether removed, although various methods were tried for this purpose. In a very short time Wright was up and around and as cheerful as a bird. From that time forth he was famous in that section as the human lightning rod."

* * *

REGARDING the recent disappearance of valuable papers owned by the Sprague Electric Company, a correspondent asks, "Is it possible that the General Electric Company has found competition in its almost exclusive industry inaugurated so successfully at Pittsburg in 1893? Is it another case of Blue Prints and ex-Detectives, Stenographers and Fire Alarms?" Not having investigated, we are unable to say.

* * *

EMIL KUNZ, a resident of Sacramento, Cal., is said to have invented a 3-ounce electric storage battery. This battery, so the inventor claims, will operate as many as fifty lights for ten hours. If this battery can accomplish what is claimed for it, which, judging from the present state of the art, would seem questionable, the problem of propelling horseless carriages is solved.

An Electric Organ.

A new organ was opened at the Seaman's Mission Church at the Bute Docks, Cardiff, last week which is worked by an electric action. This organ is supplied by the Hope-Jones Organ Company, the founder of which has devoted a large amount of skill to perfecting the electric control for organs. In this case the keyboard is placed some distance from the pipes, which enables the organist to appreciate the combined effect of the music he is playing. The electromagnets used to control each individual pipe have been illustrated and described in a previous number of our paper. The work on these electromagnets, and on the pneumatic relay by which they open the pipe, is a good example of careful design and of the accurate reproduction of interchangeable parts in quantity.—*Electrical Engineer, London.*

Tungsten Steel for Magnets.

Valtropia tungsten steel having been highly commended for permanence of magnetization and high permeability, MM. C. Chistoni and G. de Vecchi, says *Industries & Iron*, London, have carried out some elaborate experiments with it in order to test its alleged excellence. One specimen examined contained 6.25 per cent. of tungsten, 0.99 per cent. carbon, 1 per cent. manganese, 0.19 per cent. silicon, and the rest iron. Another specimen contained 4.15 per cent. tungsten, somewhat less manganese and more carbon. Comparing their magnetizations in various fields with those obtained by Barus and Stronhal, they were found to be superior to the latter. The specific magnetic moment given by these latter observers as the maximum is 23.5, whereas the maxima obtained from the Valtropia specimens were 47.6 and 55.6. As regards the demagnetizing influence of time, this is said to be not felt at all except after magnetization in the

strongest fields, and the experimenters assert that after exposure to a comparatively weak field the magnetic moment goes on increasing independently for some time. After saturation the time required to reach a stationary condition differs in various specimens, being longer in thick rods than in thin ones.

OBITUARY.

J. H. Rhotemhamel.

We are much pained to announce the death of Mr. J. H. Rhotemhamel, President of the Columbia Lamp Company of St. Louis, Mo. Mr. Rhotemhamel had been complaining for some time, and the first of the month he was advised to visit Hot Springs, Ark., for rest and treatment. Shortly after the treatment was begun he became quite seriously ill, although no instant alarm was felt or fatal consequences apprehended. After a change of physicians his family was advised to return home with him. He returned to St. Louis on February 16 and died on the morning of the 17th from congestion of the brain.

Mr. Rhotemhamel was a unique figure in the electrical industry. His struggles with the General Electric Company over lamp patents and his success in setting up the Goebel defence are doubtless well remembered in the trade; also his subsequent services in the formation of the present Lamp Pool.

ELECTRICITY was decided in its opposition to this Lamp Pool, and in its strictures may have spoken somewhat severely of Mr. Rhotemhamel for his connection with it, but for all that we sympathize most deeply with his family, and sincerely regret his demise, for he was a man endowed with personal characteristics that endeared him to every one who became intimately acquainted with him. We never for a moment doubted Mr. Rhotemhamel's earnestness of purpose, but we were obliged to most decidedly disagree with him in his views maintained during the last few years.

The disappearance from our midst of one who by his abilities and force of character attains eminence in any branch of human industry is to be deplored, and by the death of Mr. Rhotemhamel the electrical trade loses a man whose views were so original and pronounced as to make him an object of interest to all those connected with it. ELECTRICITY tenders its condolence to the relatives and friends of the deceased.

Motions of Membranes Between Electrolytes.

The phenomena of electric osmose have been utilized by physiologists for the explanation of organic processes, says *The Electrician*, London, but in all applications up to the present it has been necessary to assume that a large quantity of electricity passed before any perceptible change of configuration was produced. But that this is not necessarily so, and that certain molar movements may be produced instantaneously, has lately been shown by F. Braun. When two electrolytes are divided by a semi-permeable membrane, and a current passes from one to the other across the membrane, part of the electrolyte is conveyed into the substance of the membrane, and modifies the tension of the latter. This tension differs with the substance, and hence a reversal of the current will produce a further tension or a relaxation of the membrane, according to its direction. This may be made clearly visible by immersing a vessel filled with one electrolyte, and closed on one side with an animal membrane, into a tank containing another electrolyte in solution.

The vessel ends at the top in a gauze tube, which, half filled with the liquid, indicates the slightest motion of the membrane. Electrodes are immersed in the vessel and in the tank. Motions such as those observed have some analogy with the motion of the interior nerve substance, or the changes of form exhibited by amoebae when under the influence of an electric current. [*Wied. Ann.*]

POLYPHASE MOTORS.

Mr. Paul Boucherot recently read a paper before the Societe Internationale des Electriciens on the properties of polyphase motors with short-circuited armatures, with particular regard to their starting against a load. It is well known that the curve representing the torque of such a motor at different speeds takes very different shapes with different resistances in the armature circuit. If this resistance is small the starting torque is also small, although the current taken is very large. The torque then increases with the speed up to a maximum, and falls to zero again at the synchronous speed. The author proceeds to argue that if the resistance of the armature circuit is sufficiently great it is possible to get the torque varying inversely as the speed, which he considers to be a condition required for industrial purposes. Such a motor would, however, have a large percentage of slip at normal speeds. He proposes to get over this disadvantage by having two windings on the armature, one of low and one of high resistance. Then the sum of the two curves of torque would be a curve still decreasing with increase of speed, but at a much smaller angle, and the slip at normal speed would be smaller.

The armatures of such motors can be designed with two concentric series of holes. The external holes contain the high-resistance squirrel cage, and the interior holes the low-resistance squirrel cage. The inner and outer holes are connected by a groove tending to keep down the self-induction of the circuits. In starting, the author claims that the outer cage only acts, and he states that the low resistance of the inner one chokes back all lines of force tending to cross it. The high speed of the revolving field tends to assist this action. On the other hand, at full speed the low-resistance cage does practically all the work.

The author says that the only inconvenience of this motor is a low power factor. This comes out at 0.7, but he adds that this is not so important as is thought by some. Another type of motor for the same end consists of having two armatures and two field magnet systems. These last are so arranged that one can be displaced radially round the axis. With motors constructed on the above principle by Messrs. Brequet, a starting torque of 2 to 2½ the normal is obtained, with a current only the same proportion bigger than the normal. This is not anything especially good, as better results have been obtained by German manufacturers. In the first place, the reasoning is faulty, as the ordinary low-resistance armature does give a torque decreasing with the speed after the maximum has been passed. As the motors are necessarily worked above this maximum, no alteration is required, and the added resistance causes the speed to vary greatly with change of load. It also means loss of efficiency. Better results can be obtained by differential coupling of the armature circuit at starting, as devised by Mr. Görges and others.—*Electrical Engineer, London.*

A New Form of Fuel.

The attempts made from time to time to produce substitutes for coal, wood, etc., in the form of solid petroleum for fuel, have now assumed a more practical character in an article produced by G. H. Fullerton of Los Angeles, Cal., which is claimed to be free from the drawbacks heretofore characterizing material of this sort. By the use of certain chemicals and a peculiar treatment of petroleum in its crude state, he makes a black solid mass, which in some forms breaks almost with a fracture; it burns in the same manner as coal burns, but without so much smoke as is the case with ordinary coal, costs at the present price of oil less than \$5 a ton, and may be depended on to give out between two and three times the heat units that the same weight of coal will produce. The material may be made into any form of brick, is much cleaner than coal in handling, and has little of the characteristic petroleum odor.

THE CALCULATIONS OF THE ELECTRICAL RESISTANCES OF ALLOYS AND THEIR APPLICATION TO THE FINDING OF ALLOYS OF DEFINITE ELECTRICAL PROPERTIES.*

BY C. LIEBENOW.

(Concluded from page 84.)

We will now endeavor to ascertain how the electrical resistance of alloys must change if the percentage of their constituents is varied in cases in which the two metals are assumed to be capable of forming chemical compounds.

If we assume that the molecules of each metal consist of two atoms, pp for one metal and qq for the other metal, and if we assume that a chemical compound will exist of which the molecules contain the atoms pq , then if we add to the metal pp small quantities of the metal qq , taking care that the necessary conditions for the building of the chemical compound will be fulfilled, we will obtain at first, as is clear, an alloy which contains pq molecules and the remaining pp molecules. If we increase the quantity of qq then we shall finally reach a point where only pq molecules are contained in the alloy. If we still further increase the percentage of qq no more pq molecules can be formed, but the mixture will consist of the pq alloy plus the metal qq , and as we increase the percentage of qq we are constantly approaching a condition in which we have to deal with the pure metal qq alone.

In what way must the specific resistance of the alloy change in such a case? In the case of a simple

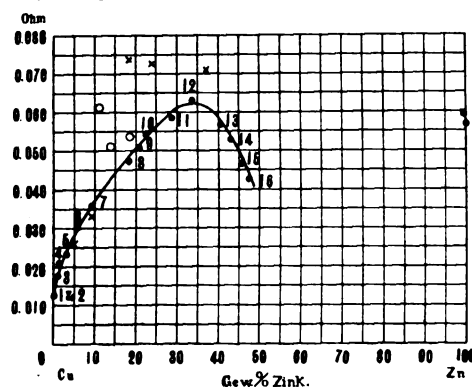


FIG. 31.

metallic compound in which all the molecules are of the same kind, thermo-electric forces could not exist. For these cases therefore the second member of our equation vanishes. As however this is the only member which causes the high temperature coefficient of pure metals to be decreased for alloys, then there is no reason for the existence of a small temperature coefficient in a metallic compound of pq molecules. If from these considerations we draw the conclusion that metallic compounds have a high temperature coefficient similar to the pure metals, then we must confess that this conclusion, which resembles an interpolation, is not a necessary but a highly probable one. If at first we add a small quantity of qq , by which an alloy $pp + pq$ is formed, we may anticipate that in this case the temperature coefficient will decrease, but later on will increase again until we reach the simple compound, where the coefficient will have about its originally high value. As soon as we pass the stage of the simple compound, by adding still more qq molecules, the temperature coefficient must again be reduced, and after reaching a second minimum it must increase again to about the original value, 0.004. The curve therefore must have an inverted peak at the point where it represents the metallic compound.

In regard to the specific resistance we are forced to conclude that the curve must first show a sharp rise until a maximum is reached, from which point it

drops down again to a point representing a simple metallic compound, and from this point the increase and decrease is repeated again exactly as the curve of the resistances shows an inverted peak where it represents a simple compound.

It is possible to construct a third curve which is much more flat than the other ones. If we substitute the conductivity for the resistances and mark them as end co-ordinates in a table like Fig. 31, and if we assume that these metals do not cause any increase of resistance when mixed with each other, we would simply have to connect the two points by a

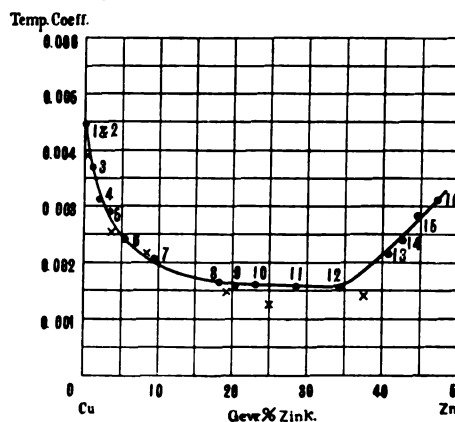


FIG. 32.

straight line in order to find the conductivity for the alloys mixed in any proportion. By the aid of the temperature coefficient this hypothetical conductivity can be at least approximately computed. If we again consider our approximate equation,

$$\gamma = \frac{A}{R} \alpha$$

where A designates the resistance in case an increase did not take place by a mixture.

$\frac{1}{A}$ then represents the corresponding conductivity.

If therefore this equation was strictly right, then

$$\frac{1}{A} = \frac{0.004}{\gamma R},$$

which would necessarily represent a straight line. As this equation however is only approximately correct, it follows that the product of the observed resistances and observed temperature coefficients divided into 0.004 must not exactly lie on a straight line but on a flat arc.

Assume that the condition for a metallic compound

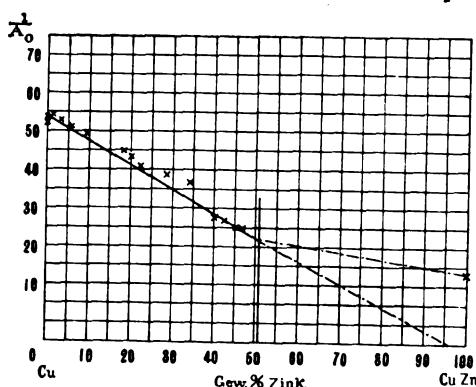


FIG. 33.

exists, then this arc will extend only to this point and will continue from it under a certain angle to the next compound or to the other pure metal.

We have therefore two peaks and one point of inflection, all three of which belong to the same abscissa, which indicates the proportion of mixture of the two simple metals in the newly compounded metal. This proportion of mixture however we will have to expect to fulfill a fourth condition, viz., that it stands in a simple relation to the atomic weight of the metals.

If these four conditions are all fulfilled we will be justified in drawing the conclusion that we have a chemical combination of the two metals to deal with.

Under all the series of observations which have come to my knowledge I have found as yet only one where I could prove the existence of a metallic compound with certainty. But even this series is not complete, and it does not even reach to the compound itself, but nevertheless it seems to me that any doubt of the existence of the compound is excluded, as I will now show.

If you will look at Fig. 31, which represents a series of observations made by Haas on copper-zinc alloys, the ordinates of the heavy black points are the specific resistances observed by Haas and the abscissae indicate the composition of the alloys in percentage by weight. Haas has connected the observations shown in Fig. 31 by a curve. In the same diagram he has marked in the observations of Matthiessen and Wiedemann—the former as crosses, the latter as circles. You will see to what a large extent these observations deviate from Haas's curve. Haas thinks these deviations due to impurities, but states himself in another place that Matthiessen has taken much greater pains in making his alloys than he has himself. Prof. Wiedemann certainly has not failed to take proper care to prepare his alloys in a pure state. If we now find that all three observers (Matthiessen, Wiedemann and Haas) have arrived at different results, I find in this one more reason to suspect in this case the existence of a metal compound.

If, perhaps, in preparing the alloys, accidentally the conditions are not fulfilled under which the one of the metals totally compounds with the other one, then in such case an alloy must result consisting of three metals which in general may have a still higher specific resistance.

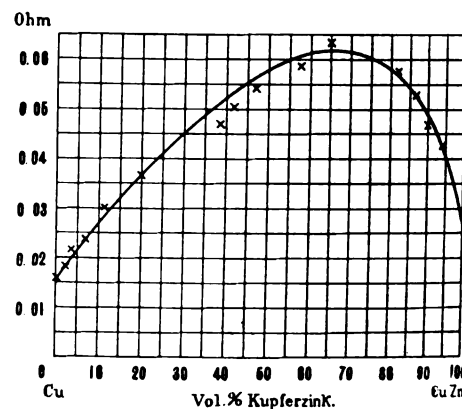


FIG. 34.

In this way the three observers, taking apparently the same percentage composition, have produced three entirely different alloys, and therefore found each widely differing specific resistances.

We will examine the curves drawn by Haas somewhat closer. Fig. 32 is the curve for the temperature coefficient. This curve shows that with increasing amount of zinc the temperature coefficient falls off very rapidly in the beginning, reaches a minimum and rises from that point about equally as fast as it fell before. The last observation is for an alloy containing 17 per cent. zinc. Here the temperature coefficient is already as large as it was for an alloy with 2 per cent. zinc. It follows from this that the state of a metal compound must be already closely approached. A copper-zinc compound which contains one atom of zinc for every atom of copper will contain 50.6 per cent. by weight of zinc. We can therefore suspect the existence of this compound in the alloys observed by Haas. The same conclusion can be drawn from the curve of resistances (Fig. 33). The left hand curve is drawn by Haas. I have added in the diagram two further observations made by Haas of pure zinc and zinc containing very little copper. The alloys lying between the end of the curved and the last two observations were so brittle that Haas could not draw them into wire. You will however notice that the form of the curve is indicated as theory requires. The curve increases rapidly in the beginning, reaches a maximum and falls

* Paper read before the Elektrotechnischen Verein on Nov. 28, 1897. (Translated for ELECTRICITY.)

down with equal rapidity. Then the curve is broken off because the following alloys were, as already mentioned, too brittle to be drawn into wire. Only two more observations were made, of which one relates to pure zinc, the other to zinc with a very small percentage of copper. The latter one indicates an increase of resistance by the addition of copper. You will notice that the two existing parts of the curve run exactly as the theory requires in the case a copper-zinc compound exists. If we now compute

from the observations the flat curve $\frac{1}{A}$ by multiply-

ing the resistance and temperature coefficient for every observed alloy and dividing this product into 0.004, we obtain the values which are marked in Fig. 33 as crosses. With the exception of one, these points lie on a flat arc which is concave toward the abscissa, and whose chord is represented by the straight line in the figure.

If there was no metal compound existing, this flat arc must tend to reach the value for pure zinc, which however is not the case. If we therefore continue the chord only to the abscissa 50.6, for which the metals are present in proportion of their atomic weights, and if we draw from this point another straight line to the cross for pure zinc, we obtain the line (in case no other compounds exist in the unobserved region) around which the further values of $\frac{1}{A}$ of the unobserved alloys must lie on a flat arc.

As the observations agree very closely, I have tried to express the values by my formula. I obtain the following equation:

$$R_0(1 + \gamma t) = \frac{1}{\frac{\% \text{ Cu Zn}}{2.9(1 + 0.00515t)} + \frac{\% \text{ Cu}}{1.58(1 + 0.00432t)}} + \frac{1000}{\frac{\% \text{ Cu Zn}}{333(1 + 0.0006t)} + \frac{\% \text{ Cu}}{1}}$$

In this equation the temperature coefficient of the internal molecular conductivity for heat of the copper is again taken as 0.0006, and this coefficient for the copper-nickel is negligible.

Fig. 34 shows the curve of resistances computed from this formula, and Fig. 35 shows the curve of the temperature coefficients. The latter one exhibits an especially close and good agreement between the values of observation (crosses) and the computed curve.

By a repetition of the experiments it may be possible to reach a still closer agreement after the preliminary constants herein given are correspondingly connected.

The last curve for the temperature coefficient shows that our formula holds good just as well when metallic compounds exist as in simple mixtures. It is only necessary to use the volumes of the compounds and not those of the single constituents in the calculations. If the volumes of the single metals are used erroneous results are obtained. As we are able to compute the temperature coefficient at least approximately from the simple formula

$$\gamma = \frac{A_0}{R_0} 0.04,$$

we have in this a guide, in case only a few observations are made, to judge if the metals are building a compound or not.

If from this standpoint all observations of Matthiessen are considered, we find that we have a reason to assume the existence of a metallic compound only when one of the metals zinc, tin, lead or cadmium is alloyed with any other metal.

This proves that these metals either always or at least very easily form compounds if melted together with the other metals. The difference in the behavior of this as compared with other metals I believe is caused by the fact that their molecules con-

tain in the solid state, and also in the liquid or gaseous state, only one atom, whereas the molecules of the other metals consist of more than one atom.

It is not necessary to melt metals together in order to form metallic compounds (compound metals), but they can be formed also in the cold state.

If we cover platinum, for instance, with zinc electrolytically, we are not able to peel off the zinc like a copper deposit. Even if we use strong acids which easily dissolve zinc, and even when we pulverize finely the zinc-covered platinum and treat it with acids, we cannot completely remove the zinc in any of these ways. It is apparent that zinc has gone into chemical combination with the platinum.

The condition for the chemical combination is in any case that the equilibrium for their combination is a more stable one at that particular temperature than that for a simple mixture. The atoms of the compound must hold themselves more strongly together than in a simple mixture. These conditions however will change with the temperature. We now assume that below the melting point of a certain metal composition there is a temperature at which the equilibrium for the compound is the same as for the simple mixture. And we will further assume that above the melting point one and below the melting point the other is overpowering. If we now form the composition by melting the metals together and then cooling the alloy as quickly as possible, the solid metal will not be in a state of internal

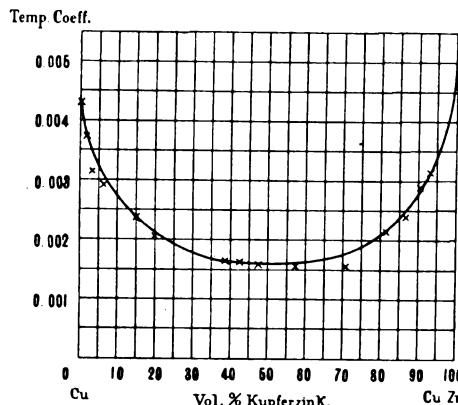


FIG. 35.

equilibrium. But in solid bodies, also, chemical actions go on very slowly, and in proportion much slower the lower the temperature is. In such a case, therefore, the internal constitution, and without it, for example, the electrical resistance, will slowly change. Such an alloy has been found by Feussner in the copper-nickel zinc alloys. Simple copper-nickel alloys do not change their resistance. If they however contain zinc, the resistance changes slowly. These changes will go on for years in the cold. If they are heated however to a temperature from 100° C. to 150° C., not only their resistance changes within a short time but also their structure. They become crystalline, brittle, and fall apart. Whether the compound is formed later on, or whether the compound which has been formed at a high temperature decomposes at a lower temperature is uncertain. These are matters that require further investigation.

If however a metal compound is more stable than a mixture at a low temperature, it requires more work to separate the molecules than would be required for the separation of molecules in mixtures. The so-called tension of dissolution is depressed, the compound metal is harder to be dissolved in acids, and it approaches in its properties those of rare metals. I have reasons which make me suspect that there exists a compound of copper-wolfram and lead which in many respects has similar properties to the expensive metal, platinum.

The conductivity for electricity also changes as soon as the compound is formed. The above-mentioned copper-zinc compound, for example, has a better conductivity than would be anticipated from the proportion of its parts.

If therefore we investigate all possible combina-

tions of metals, we may probably find compounds of exceedingly high conductivity, probably higher than silver or copper.

But would it not seem likely that such alloys might have been found accidentally a long time ago?

This is very improbable, as we have seen that small additions reduce the conductivity to a considerable degree. If therefore one of the two metals is slightly in excess, or if all the conditions were not complied with by which the metals are completely compounded, then we shall always have relatively high resistance.

The possibility however to study all these conditions is given to us if we compute the resistances of the series of alloys as I have shown you.

ERRATA.—In the equation of the above article near the top of page 69 of our issue of February 9 the multiplication sign in the denominator of the fraction should be a plus sign. On pages 83 and 84 of our issue of February 16 all the multiplication signs in the first four equations should be plus signs.—ED.

ELECTRIC LIGHTING FOR PROFIT.*

BY ALEXANDER DOW.

This subject is one which every member of this Association has studied and concerning which every member must have opinions. I have selected it for the paper which your Secretary asked me to present at this meeting, because I have opinions of my own which I think may be of interest to other electric light men, and which I want to hear discussed and criticised and contradicted by you who are qualified by experience to do so.

I submit as the first proposition that we are all in business to make a profit. I don't expect to be contradicted on that proposition, although some may wish to so amend it as to indicate that they are at present content if they can avoid a loss. As a second proposition I submit that the conditions of the electric light industry have so changed in the last few years that the opportunities of profit are limited; that the margin between earnings and expenses tends to vanish and can only be kept in view by unceasing endeavors to increase the one and reduce the other. The days have departed when a neat dividend could be paid on a small business done at high prices, and now if a dividend is to be paid at all it must be earned by doing all the business that can be obtained and at prices set but little above the actual cost of production. As the preceding statement forms the text of this discourse I ask your attention to its repetition, as follows: I believe that the proper policy of electric light management under the conditions of the present time is to sell electric energy to every accessible user in any shape that the user requires, and at the lowest price which will pay a reasonable profit on the capital invested.

A NEW POLICY FOR NEW TIMES.

Those of you who were in the business at its beginning will recognize in this profession of faith the converse of the rule which then governed us. We used to believe in a "system," and the people who taught us to so believe charged us so much for the experience and the incidental machinery which we acquired that we in turn had to collect great prices for the product sold to our customers. The rule was to get out of the business all that it would stand; and if a possible customer did not like the particular kind of energy which our "system" furnished, and thought he would like the kind which some other alleged system was supposed to produce, we considered him a heretic. Electric light was then a novelty and a luxury and a mystery, and was to be respected and paid for accordingly. Nowadays it is a thing of domestic use; the machinery for its production is sold as freely as any other machinery; the principles governing its distribution are taught to all who desire to learn, and its supply is recognized as a customary or even necessary public service

* Paper read before Northwestern Electrical Association, Milwaukee, Wis., January 19, 1898.

exactly as is the supply of gas and water. It is proper that we should announce a policy suited to the new condition. That many have done so I know, and also that some have long been governed by just such a policy as I advocate; but there still remain, to the detriment of the business at large, some who are trying to run their affairs on the old plan. They do not profess to do so, and if challenged they may plead the old excuse, that the cost of their plant and the losses incident to its first operation have been so great as to require high prices for the energy sold. That excuse is not valid in these latter days. Taxing customers all they will stand means competition either by an opposition plant or by the municipality; and either of these means ruin to the station which is run on the old lines.

Of course I do not intimate that any member of this Association is managing his business to-day after the fashion of the eighties. But each of us knows of some plant in the next town to ours which is run just that way. That plant is going to fight it out on the old line until it is wiped out by a municipal plant, and the municipal plant will publish a report to the whole United States that it has reduced the price of lighting thirty or forty per cent. Then you and I and each of us is going to have the trouble of explaining at great length to our own particular municipal authorities why a municipal plant established in our town cannot possibly make any similar reduction.

Gentlemen, the man who used to sell experience to us is probably to-day trying to show the ambitious city fathers of that other town next to ours how well they can serve their constituents and how much honor they can obtain from society at large by engaging their municipality in the electric lighting business. Our friend with experience to sell is not one bit more exact in his statements than he used to be long ago, and we cannot honestly say that his operations are beneficial to our business; but he is less detrimental than the man who gives him a chance to get in his work, the man who ought to be giving good service to a satisfied constituency, but who is furnishing lights that are a disgrace to the "system" and its owner, and trying to collect higher rates than those at which you and I are giving first-class service to our public.

WHAT IS A REASONABLE PROFIT?

This is a much-discussed question. The man in the next town believes that a reasonable profit is everything he can get, and at the other extremity of belief is the man who holds that no public service should pay a profit to any individual. Between these limits will be found the opinions of the great majority of Americans, whose democratic training has taught them that the commonwealth should not undertake any work which can be satisfactorily performed by private enterprise. Those members of this great majority who have money invested in manufacturing or in commerce, recognize that a reasonable profit means something more than can be obtained by the investment of their funds in Government bonds or by placing them in a savings bank, and yet something less than is hoped for when the investment is of a speculative character, involving risk of total loss of capital, such as the exploiting of a new mine or the insurance of an overdue vessel and its cargo.

I believe that after operating expenses are paid and any deterioration of the investment shown by a carefully made inventory has been made good, a dividend such as is paid by a good manufacturing business is reasonable for electric lighting. Such a dividend will necessarily vary with the line of manufacture—those concerns who manufacture a staple having a practically constant market being satisfied with a narrower margin of profit than those others where the production has to be varied from time to time and new markets developed at intervals. The same considerations govern in the electric lighting business. A station which is well established, has no ruinous competition to meet, is not threatened

by municipal interference, and is not obliged to continually risk money in extensions of an uncertain character, may well pay a dividend but little in excess of the current rate of interest in savings banks. The station in which all these conditions are reversed, particularly when there is a prospect of its investment being wiped out by causes which its management cannot control, is entitled to a greater return.

There is much work to be done in the education of the public to a proper understanding of the economical principles underlying this subject. The citizen who has theories about municipal service does not apply these to his own affairs, nor will he apply to his theories the rules which govern his personal practice until you show him that this should be done. He thinks it no harm that he should draw from the capital invested in his own business ten or fifteen or twenty per cent. in addition to a fair salary for management and any loss that is shown by the annual inventory. He thinks it entirely proper that he should build up a business worth much more than its nominal capital by returning into it a large annual surplus. But he will denounce as extortionate an electric lighting company which pays a good deal less than ten per cent., and for such a company to show a surplus is in his eyes *prima facie* evidence of robbery of the public. He on the one hand refuses to protect the public service corporation from unlimited competition, and on the other hand demands that it do business for a rate of profit accepted only on the safest class of investment bonds.

In Europe they are more logical. They limit the price which a company may charge to its customers and the dividend which it may pay to its stockholders. They require the company to give good service to all who demand it within a certain area. But at the same time they permit no competitor to enter the same district, and they provide for the purchase of the property at a reasonable price in the event of the franchise not being renewed at its term. Where they restrict they also protect. Our theorists have yet to learn that these two actions should go together, and it seems to be our affair to teach them this lesson.

HOW SHALL RATES BE MADE?

There has been of late much discussion of this subject at Conventions and in the electrical press, and with good reason. American practice has heretofore been to make rates without sufficient analysis of cost, and particularly without attempting to make each unit of energy sold bear its proper share of the standing charges of the plant. Premising that we are to readjust rates for a minimum profit, we must do so according to a carefully considered system. It will not do to make a horizontal cut on the present schedules, because analysis will show that some business now done at the highest rate is not profitable, and a reduction of rate should only be made on business that is profitable.

It has been said that American customers insist on a uniform rate—a "one-price American plan" method of charging. I do not find it so. I have no difficulty in explaining to those customers whom I meet why some business should pay a higher rate than other business; and other electric light men tell me that, after they have got the principles involved clearly defined in their own minds, their experience with customers is similar to mine.

The base of any system of rate-making must be an analysis of the costs of production. The method of analysis which I have found most useful is that proposed by Mr. Arthur Wright. The paper read by that gentleman at the last meeting of the National Association is doubtless familiar to you, but as American conditions usually differ from those existing at Brighton, it is seldom possible to apply the short method of estimating standing and running costs which Mr. Wright found convenient, and an analysis in detail must be made. I use the following method. Consider what the condition of the station would be if you were obliged to be ready to do the same busi-

ness that you now do and during the same time but had no customers taking current. You would have fires lighted, men on duty, dynamos turning over, lines strung and connections made to customers' premises. You would burn enough coal to keep up steam and keep the dynamos in motion, and you would have enough help for these conditions. But you would not burn so much coal as if the machinery were running at full load; and you might need less help. Your lines would be out in the weather or buried in the ground, and that deterioration which is due to time and to climate would go on just the same and would have to be made good by a repair gang. But you would not need renewals of incandescent lamps or carbons, and you would not keep any men to put in fuses for customers or to read meters. You would need a manager and an engineer and an electrician just as you do now, but you would not need a bill clerk nor a collector, and you might do without an office boy. My rule is to ask whether the item of expense under consideration would continue or would cease under the conditions described. If it would continue it is a standing charge. If it would cease it is a running charge. It is clear that taxes, insurance and interest are standing charges.

Mr. Wright has shown us that it costs us a great deal of money to get ready to serve a customer, even though the customer only requires service for a single hour in a year. This amount he calls the standing charge. He has pointed out that a uniform rate takes no account of this, but is apparently based on the assumption that it costs just the same to furnish current to a customer for one hour in the year as for each hour of one thousand hours in a year. He argues correctly that in making rates we should take account of a customer's load factor, and he goes on to describe an ingenious method and an ingenious device invented by himself for taking such account. Whether we adopt his device or not we must all admit the correctness of his statement of the conditions governing costs of production, and we must if we are hereafter to do business at a profit make our rates with a due regard to these conditions.

To discuss in detail the whole theory and practice of rate-making is beyond the scope of this paper. I advise each of you who has not already done so to make an analysis of your costs in such manner as to distinguish between standing and running expenses. Using Mr. Wright's paper as a text book, you will find (as I did) that the labor is well paid for by the results obtained. Properly tabulated these results will show what business is profitable at any given rate or what rate should be made on any given business. My analysis showed me that I could afford to sell current to a large class of users at $4\frac{1}{2}$ cents per unit while a rate already established at $14\frac{1}{8}$ cents for another large class was not profitable. Now I am taking all the $4\frac{1}{2}$ cent business I can find and am letting other people hunt for the $14\frac{1}{8}$ cent skind.

CLASSES OF BUSINESS.

The immediate business of an electric lighting station is to supply incandescent and arc lighting, and power for stationary motors.

Some small plants limit their business to lighting, and thereby avoid operating during the daylight hours. I think that this is often done without good reason. There is in nearly every village some demand for power, or such a demand can be developed by an enterprising manager. It is likely that the rates to be obtained for power will be very low, but if they will pay the additional cost of running the station during the daytime and also carry some proportion of the standing charges, these low rates may be profitable indirectly by reducing the amount of standing charges remaining to be earned by the lighting business. It is certain that interest, insurance and taxes run for twenty-four hours a day although the plant may only operate for twelve, and if the power load will pay half of these items, in addition to its actual running cost, it is worth having.

Some stations do not run all night. The people in the village where such a station is located may go

to bed early and may not use any appreciable amount of current after 11 o'clock or midnight. But I have always found it difficult to work up a good business in residence lighting unless the plant undertook to give all-night service. Apparently customers do not care to have a duplicate lighting equipment in their residences. They do not fully appreciate the beauty of incandescent lighting if it cannot be switched on at any moment when it is wanted. People sometimes want lights between midnight and morning in their houses, and I suppose will continue to do so as long as our children come into this world with unreasonable ideas as to the part of the day in which they should do their sleeping.

I am sometimes told that residence lighting is unprofitable. It surely is if every residence that is served requires an independent transformer, and if only one residence in a dozen takes current at all. The only way to do residence lighting at a profit is to do all the lighting or nearly all that there is in a given residence district, and for this purpose the rate must be placed so that every possible customer can afford it. I have tried the experiment of low residence rates on a small scale more than once, and in each instance with success. It is to be tried now on a large scale in several stations and I am certain that the experiment will be successful. The load factor of residence lighting is much better than the average load factor of many stations.

A GENERAL DISTRIBUTION SYSTEM.

It is a serious handicap to a station when it is obliged to run two or three separate types of dynamos and to maintain two or three separate distributing systems for the supply of different forms of energy. The best practice to-day is to furnish incandescent lights, arc lights and electric motive power from the same dynamos and same mains. This is a subject to be considered in the original plan of the station, but there are instances where old stations have been rearranged with decided financial advantage. When a power load can be had even at the low rates already spoken of, a study of the local conditions should be made with a view to seeing whether a general distribution system will not be a source of profit. To design a new station with anything but such a system is almost criminal.

SUPPLY OF STREET RAILWAY CURRENT.

There has not yet been devised a satisfactory system whereby a supply of 500-volt current for railway work can be combined with a general lighting distribution. Therefore a proposal that a lighting station should furnish such current must be dealt with as involving a new investment. This investment is always the cost of dynamo and switchboard, and usually the cost of an engine. The street railway evening load in winter time coincides with the heaviest load on the lighting system for about two hundred hours per annum. At all other hours the street-railway demand is a desirable addition to the load on the boilers, and in most stations the dynamo and switchboard can be cared for without cost for additional help. If the boilers are properly designed to suit the conditions, they may be driven beyond their usual rate during these two hundred hours with greater profit than would be possible if additional boiler capacity had to be installed. Furnishing street-railway current appears therefore to be equivalent to the sale of steam to a special engine and the furnishing of attendants to an additional engine and dynamo, and it should be considered as a business proposition on that basis and not in the same manner as a demand for current from the electric lighting plant.

STREET LIGHTING CONTRACTS.

If street lights can be served from a general distribution system the rate should be made in the same manner as the rate for any other service from that system. As street lights usually run about four thousand hours a year, a rate made on a scientific basis will be very low in comparison with the rate for ordinary commercial lighting. This is not in accordance with the old practice of making all the

profit of the business on a street-lighting contract, but it is distinctly in accordance with the more modern practice which will probably become general.

Municipal contracts which can be performed without investment in special machinery are desirable business, in that the payment is prompt and absolutely secure and that the conditions of their performance are clearly laid down in the original agreement. For that reason the tendency appears to be to take such contracts at a very narrow margin of profit.

But when the performance of a street lighting contract requires an investment in special machinery and the building of special lines, such a contract is usually undesirable business. It is impossible under present conditions to secure such prices for street lighting as will return the investment to the stockholders within the term of the contract. The contracts are usually short and there is no surety of their renewal. If in dealing with a municipality one were dealing with a business corporation having an established policy it would be justifiable to take such chances, but our American cities, if they have a policy at all, change it from election to election, and no contractor can tell that the service which was deemed perfect by the board with whom he made his contract will not be entirely unsatisfactory to their successors with whom he must make a new contract two or three years hence. In this respect we have another lot of educational work out for us. If we could make it clear to the mass of our citizens that the price for a year's street lighting depended on whether the street-lighting plant would be employed next year or would be standing idle, we might have some chance to make close bids without feeling that we were engaged in a risky speculation. The peculiarly exasperating part of the whole subject is, that those same theorists who object to asking for bids on a contract running more than two or three years are usually ready to look up the good money of the citizens in a city plant which has to be security for thirty-year bonds.

SPECIAL SOURCES OF REVENUE.

In many localities there are opportunities whereby the power of a lighting plant may be employed in work which is not usually considered as part of the lighting business. An arrangement with a manufacturer whereby machinery required by the plant during evening hours will be used by the manufacturer in the daytime is often possible. A similar arrangement is made in many places for the joint use of a water power. The sale of exhaust steam for heating purposes is another source of revenue which is frequently neglected.

HOW CAN BUSINESS BE HELD WHEN ONCE OBTAINED?

In these days of competition this subject becomes of the greatest importance. We have against us in every station some competition. In the larger cities we have to meet the offers of opposition companies doing a similar business to ourselves, the arguments of the man who wants to sell isolated electric plants to our best customers, and the ever-present cheap service offered by the gas company. In the smaller towns and villages the worst obstacle to the holding of business is the tendency of our customers to economize by cutting down the amount of light used. This tendency is present also in the large cities, but is not so constantly in evidence because many city people must use light liberally in order to carry on their business. The whole law and gospel of holding business consists in getting your customers to believe that they receive good value for their money. It is not sufficient that you believe it, you must convince the customer. But it tends to make your success more certain if you know in your own mind that you really are giving good value. For this reason it is essential that you know what each block of lighting costs, which brings up again the subject of analysis of expenses.

No matter how cheaply you offer to sell your products, it is essential that the customer be satisfied with what is delivered to him. Therefore, if he

wants to use arc lights, you must see that they are quiet and steady. If he buys current from you wherewith to operate a motor, you must make it your business to see that his motor runs satisfactorily. It is not a part of your contract to do this, but if the motor does not run as it should you will go up there some day and find that he has bought a gas engine. If you sell him current for incandescent lighting, you must see that the lamps are renewed before they become dim. If you cannot get the customer to buy new lamps, you had better arrange to furnish renewals free, as most stations now do. If even then your customer is slow about calling for renewals, you had better send one of your men up to change the lamps. Neglect in this respect probably means that there will be a sale of Welsbach burners in the neighborhood of that customer. You must be prepared to send assistance to him when he mixes things so that fuses get blown, and you must send this assistance promptly. This may mean that a man has to idle around the station waiting for trouble calls, but you should not think that man's idleness gives you a chance to economize by discharging him. You should look upon it as the outward and visible sign that your customers are getting good service. And above all, you must take such precautions that your service may be relied upon by all who employ it. There is nothing that does so much to damage the business of a station as a reputation for unreliability.

CONCLUSION.

In closing I wish to say that I am preaching no doctrine which I do not believe, or which I do not try to follow. Neither do I imagine that the stations represented in this Association are less carefully planned or less efficiently managed than those of the rest of creation, that I should address myself to you rather than to others. But it is by electric light men and no others that the advice must be given to those who need it, and each of us has the opportunity at some time to counsel with the man in the next town of whom we have been speaking. While I was in the act of preparing this paper I was asked for advice in just such a case, and gave verbally just the same advice that I was putting in writing for presentation to you.

This is a final summary of the opinions I have presented:

(1) The electric lighting business should pay a reasonable profit, approximately the same rate as any manufacturing business which has similar risks. This profit should be paid after the expenses of operation, maintenance, and depreciation shown by the annual inventory have been provided for.

(2) Rates for electric supply should be so adjusted that each unit sold will pay its share of operating and standing charges, and in addition thereto a uniform proportion towards profit. No business should be done at a loss, and no business should pay more towards profit than its proper share.

(3) Every class of business that can be profitably done should be obtained. Business that improves the load factor should be taken if it can be obtained at any price greater than its share of operating and standing charges, because the improvement of the load factor reduces the amount of standing charges to be borne by the existing load.

(4) Business once obtained should be kept by careful study of and prompt attention to the requirements of each customer. It is not possible in the present stage of electric development for an American electricity supply company to limit its interest in the supply to its delivery on the customer's premises. It must do much work in order to secure that the customer uses the supply to the best advantage. It is not sufficient that a customer should be well served, he must also be well pleased.

(5) There is need of educational work to be done among electric light men, among municipal authorities and municipal theorists, and among our own customers. It is our interest that this educational work should be done, and as it does not appear to be the duty of any other person to do the work, we will have to do it ourselves.

STANDARD SYSTEM OF ELECTRICAL DIAGRAMS.

The committee appointed a year ago by the Chicago Electrical Association to make a group of diagrams of the common parts used in electrical construction, for the purpose of originating a standard code to be adopted by the Patent Office, recently submitted its report. The two first plates of a series of eight are herewith shown. The committee's report states that often in a drawing accompanying an application for a patent, when a circle was used to represent a battery, and another circle exactly like it to represent a dynamo, and still another, differing in no respect, representing the ground, the drawing was necessarily confusing, and was followed with difficulty, if at all. In such cases it has not been infrequent for the Patent Office to suggest to the inventor or his attorney that he submit a new drawing, using a certain adopted form or diagram to represent his battery

This form of diagram may be used for any direct current machine in drawings where the form of the winding of the machine is either well understood or is not essential in the system to be represented. Similarly, the figure below it may be considered the generic alternator. Where it is necessary to show particularly the kind of a machine, the field coils may be added, as shown in the next three figures, which are so simple that they can not be misunderstood by one accustomed to read electrical diagrams. In the diagram of the tri-phase dynamos or motors are shown the characteristic windings of their armatures only. Where there is room for a doubt as to whether one of these diagrams represents a motor or a dynamo a letter M or G, as the case may be, will clearly distinguish them.

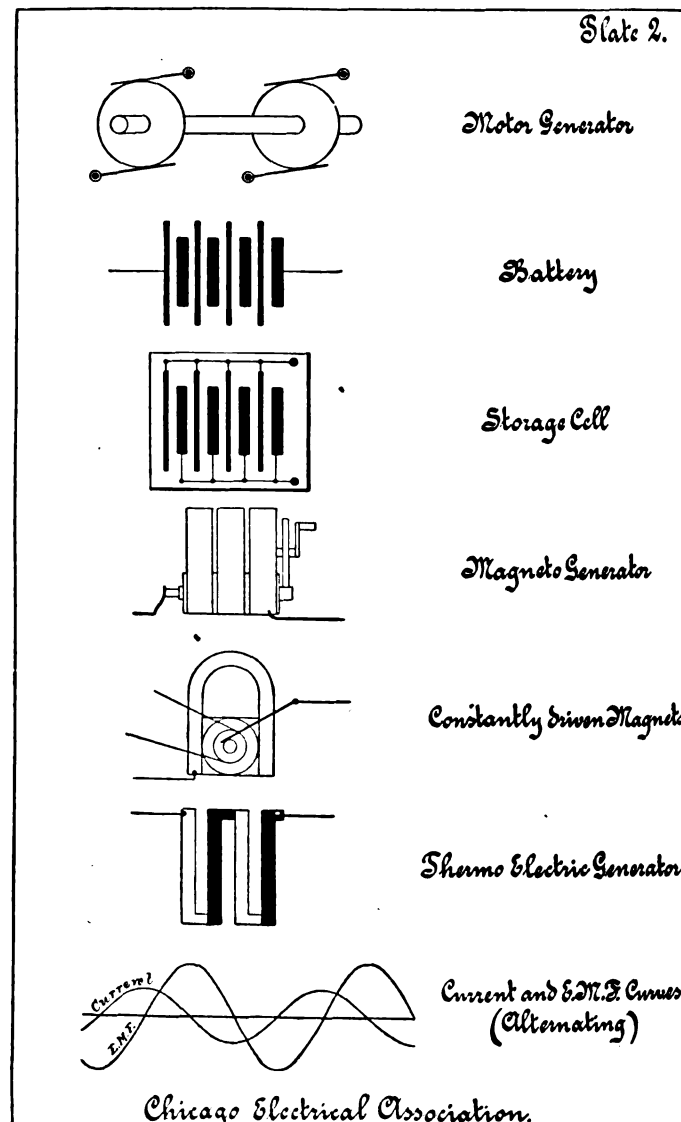
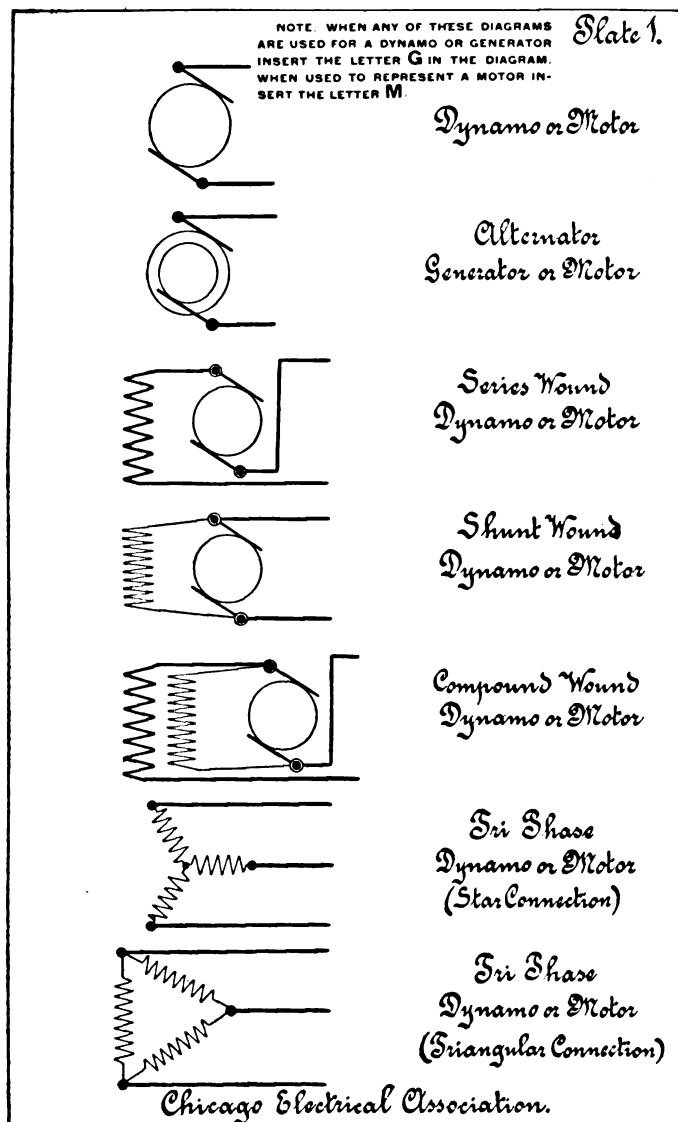
The diagram representing the motor-generator will, perhaps, be subject to adverse criticism. In its adoption, good perspective is undoubtedly sacrificed

terms where it is often difficult to distinguish between the hand generators at the subscribers' stations and the power generators at the central office.

The remaining diagrams will appear in future issues.

Electro Chemical Equivalent of Carbon.

This abstract gives the conclusions of a paper by A. Coehn. When carbon is employed as the anode in the electrolysis of liquids which evolve oxygen, it is not only mechanically disintegrated but also chemically acted on, the nature of the latter action appearing to depend on the electrolyte employed. For example, a current of 0.12 ampere is passed through six cells furnished with anodes of pure carbon and cathodes of platinum, and containing sulphuric acid diluted with 1, 10, 20, 50, 100, and 500 volumes of water; after ten hours the most concentrated solution is colorless, the most dilute dark



and another to represent his dynamo, and so on. In this way, and with the well directed efforts of a number of patent attorneys, a great improvement has been made. These diagrams are to further assist in this direction.

It is well to state that no attempt at originality has been made in their selection. All available sources of information have been drawn from, and it has been the aim of the committee to adopt the best, regardless of whether they had been in common use or not. In deciding upon the diagram for any particular piece of apparatus, the question was considered from several standpoints. Simplicity always carried the greatest weight, and when several diagrams of apparently equal simplicity were to be chosen from, that one was taken which seemed most suggestive of the actual piece of apparatus represented.

The representation of a dynamo or motor by a circle with two tangent lines showing the commutator and two brushes has long been in common use.

for ease in drawing, but who can say that the diagram is not suggestive of what it is intended to represent?

The differentiation of the diagrams for the primary battery and for the storage battery from each other and from the ordinary diagram for a condenser, has been the subject of a good deal of thought. The primary battery diagram is the one in ordinary use. The storage battery diagram differs from it by having the plates connected in multiple, as in practice, and by the drawing of a square around it. This diagram will hardly be taken as representing a condenser, for the reason that the lines representing the plates of the battery are made thicker than those connecting the plates to the battery terminals.

The reason for not representing the ordinary hand magneto-generator and the constantly driven generator by the same diagram is that a need actually exists for a distinction between them. This is especially so in diagrams of telephone exchange sys-

brown, and the others of intermediate shades of color. At higher temperatures there is less mechanical disintegration, and the electrolyte is more strongly colored than at lower temperatures. The mechanical disintegration is inconsiderable at 100 degs. in a solution containing equal volumes of water and concentrated sulphuric acid. A determination of the loss of weight of a carefully purified carbon anode under these circumstances gave the number 3.5 as the electro-chemical equivalent of carbon, but some mechanical loss had occurred. A further series of determinations were made at the ordinary temperature with sulphuric acid diluted with from 10 to 500 times its volume of water, the particles of carbon lost mechanically being collected and their weight subtracted from the total loss of weight of the anodes. The electro-chemical equivalent thus determined varied from 2.7 to 3.0. The number obtained is thus independent of the concentration or temperature of the acid, notwithstanding the apparent difference in the action.—*Electrical Engineer, London.*

Electrical Tramways in Europe.

The substitution of electricity for horse traction on the tramways of the great cities of Europe is coming more and more to the fore every day, and as evidence of this, it may be mentioned that at the present moment the municipalities of Berlin, Vienna and Moscow are all engaged in the preliminaries for the transformation of the existing tramway systems. The two chief Moscow companies are negotiating with the authorities for permission to amalgamate the existing lines and utilize electric power on same. The work of installation will probably be entrusted to the Berlin firm which is promoting the scheme. As far as Vienna is concerned, arrangements are now being concluded for a trial use of electricity on part of the tramway system of this town. The *Oesterr. Ungerisches Eisenblatt* states that it has been decided not to experiment with overhead wires, but that the communication of current by means of a central track-conduit will be adopted. The work is to be jointly carried out by two firms, one of which is German, the other Austrian.

Electrical Apparatus for Great Gull Island.

On March 3, 1898, Major Leach, the United States Engineer at New London, Conn., will open bids for installing an electric light and power station at Great Gull Island, N. Y. The engine is to be a 28 BHP. oil engine of the Hornsby-Akrod type, provided with oil tank, water vessel, and water and exhaust connections, supplementary governor and two flywheels. The generator is to be one multipolar 15 kw. direct current, constant potential, compound wound, belt connected, 250 volt dynamo, provided with a rheostat that will regulate the voltage from 5 degrees above the normal to 20 degrees below, and with a switchboard for cutting out compound winding, and shunt-field arranged to secure the maximum rated voltage of the generator. The generator must be of the latest and most efficient type. The armature is to be of the type known as ironclad. It must be capable of running its full rated capacity for five hours continuously. Three switchboards are required. The conductors are to be insulated according to U. S. Navy specifications, to be of soft-annealed pure copper wire, heavily and evenly tinned, and having a conductive of not less than 96 per cent. of pure copper of equal cross section. Two storage batteries are required, each to consist of 54 chloride accumulator cells complete, with glass jars, oil insulators, bolt connections and sand trays.

Intending bidders desiring any further particulars can obtain same upon application to Major Leach.

The Harrisburg Foundry & Machine Works.

On February 1st Mr. M. E. Hershey, general manager of the Harrisburg Foundry & Machine Works, Harrisburg, Pa., severed his connection with that company, and Mr. W. R. Fleming of the firm of W. R. Fleming & Co. of New York, Boston and Philadelphia, has been prevailed upon to accept the position of vice-president and general manager of the works. This change took effect February 1.

The Harrisburg Foundry & Machine Works contemplate a considerable increase in their facilities for manufacturing automatic engines for electric service. It is intended to add several new lines of engines so as to broadly cover the whole field of steam-engine practice.

It is also understood that the company will rebuild their entire plant upon a plan and scope which will place the concern in a superior position for the manufacturing of their machinery, which is so well known throughout the country at large.

Bids Wanted.

Sealed proposals are being invited until March 24, 1898, for electric lighting and power installation at Plum Island, N. Y. Specifications and blank forms of proposals can be obtained upon application to Major Smith S. Leach, United States Engineer, New London, Conn.

LONDON NOTES.

[From our London Correspondent.]

Cathode and Roentgen Rays.

On February 4, at the Royal Institution of Great Britain, Mr. A. A. Campbell Swinton lectured before a distinguished audience on "Some New Studies in Cathode and Roentgen Radiations." In Crookes tubes it was possible to deal, not with aggregates of matter but with a few, perhaps, single molecules, and this was the reason why so much attention was being devoted to this branch of physics. Mr. Swinton showed experiments to illustrate the deflecting power exercised on the cathode rays by a magnetic field; and the erosive action of the rays upon the glass of the tube was also exhibited, the glass being roughened on the interior surface. A cathode ray electric lamp was used for focusing the rays from two concave electrodes on a piece of lime, which, under their influence, was raised to brilliant incandescence. One effect which he was at a loss to explain was that the lime glowed brightly and faintly in alternations; moreover, although an alternating current was used, the light appeared now on one side of the lime, now on another. In regard to the nature of the cathode rays and the distribution of the electric field within the tube, he pointed out that a pith ball, which might be taken to represent an atom, vibrated with equal velocity in each direction between two electrified plates, but that if one of the plates were connected to earth instead of to the electric machine, the vibrations were slower in one direction than in the other. Analogous conditions he conceived existed in the tubes. The bulk of the atoms were positive and moved with comparatively small velocity, only those behind the cathode and those forming the stream coming off from the cathode being negative and moving at a great velocity. The existence of an anode stream could be proved experimentally by means of a tube containing a revolving vane (like a radiometer) whose position was variable at will. Put in the cathode stream it rotated very quickly in one direction, but if brought closer to the glass it came under the influence of the stream of positively-electrified atoms from the anode and rotated slowly in the other direction.

Personal.

Mr. O. C. Hirtzell, treasurer of the Eureka Tempered Copper Works, North East, Pa., was in New York last week on business. He spoke encouragingly of the business outlook and reported his own works as running overtime to fill orders.

Mr. John McKay, who has been engineer and superintendent of the Electrical Exchange Building for some time, has been appointed supervising engineer of the following large buildings in New York: American Surety Building, Queen Insurance Company Building, German-American Building, White Building, Parmley Building, Sohermerhorn Building and the Electrical Exchange. The position of supervising engineer for these large office buildings is a very important one, and the selection of Mr. McKay is a recognition of his ability as an engineer. His promotion was deserved and places the right man in the right place.

The General Offices of the National Association of Manufacturers in Philadelphia, including the office of the president, Theodore C. Search, have been removed from No. 1743 North Fourth street to the Bourse, Fourth street below Market.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

Telegraph Tournament at the Electrical Exhibition.

An exceedingly interesting feature of the Electrical Exhibition to be held in Madison Square Garden, New York, next May, will be the telegraph tournament. An educational committee has been appointed to look after Exhibition matters other than commercial, and this committee has decided that one or more evenings during the Exhibition shall be set aside for the telegraph tournament. This will undoubtedly be the greatest tournament of the kind ever held in the world. Mr. Fred Catlin, well known in telegraphic circles, has consented to conduct the affair. Judging from the number of previous successful tournaments Mr. Catlin has managed, the contest next May should be eminently successful. Mr. James D. Reid, of world-wide reputation, is to be chairman of the board of judges.

It is the intention of the management of the Exhibition to spare no efforts to make this feature of the great show a most attractive and successful one. The prizes will be unusually liberal and the contests numerous. Those who desire to participate in the tournament may depend upon being well taken care of.

Meeting of the New York Electrical Society.

The 185th meeting of the New York Electrical Society, in conjunction with the New York section of the American Chemical Society, was held at the College of the City of New York, February 11.

Mr. Joseph Wetzler lectured on "Electricity Direct from Carbon."

Dr. Chas. F. Chandler, Dr. Morris Loeb, Dr. E. A. Doremus, Messrs. Samuel V. Essick, C. O. Mailoux, J. J. Carty, T. C. Martin and Max Osterberg took part in the discussion.

The following members were elected: Prof. Robert Ogden Doremus, Max Loewenthal, James H. Bates, Raymond W. Charles, W. L. Hedenberg, Frank Martin, F. A. Pattison, Geo. C. Hoffman, Thorburn Reid, Robert Lozier, Prof. Sidney H. Short, Geo. Sommer, John J. Swann, Meyer S. Blumberg, Frederick W. Young, Wesley Gray Gilmore, Edwin Adelbert Howe, H. F. Sanville.

Electrical Applications Awaiting Action in the Patent Office.

Among the 13,336 applications awaiting action in the Patent Office on the 15th inst. were 258 on metallurgy, metal-founding, electro-chemistry, etc.; 307 on telegraphy, telephony, electric lighting and signaling; 220 on electricity generation, distribution, motive power, electric railways, etc.

LEGAL NOTES.

Vice-Chancellor Grey, at Camden, N. J., on the 14th inst., appointed J. Frank Shull, of Glassboro, receiver for the Pitman Grove, Glasboro & Clayton Electric Light Company. The liabilities are placed at \$4,000 and the assets at \$10,000.

In the short calendar session of the Superior Court at New Haven on the 11th inst. it was stated that the settlement of all the affairs of E. S. Greeley & Co. of New York, now in the hands of a receiver, would be made in the Superior Court at New Haven. A receiver was appointed for the concern in New York, but the consideration of the claims against the concern and the adjustment of its affairs will be concluded at New Haven, where the firm had an office and where E. S. Greeley, the principal owner of the concern, resides.

At a special term of the Supreme Court at Utica, a few days ago, a hearing was given in the case of the Edison General Electric Company of Schenectady against the Western Electric Company and E. G. Bernard of Troy, for the infringement of a patent. This action is brought to debar the defendants from manufacturing a motor a portion of which, it is asserted, is covered by a patent held by the plaintiff.

In a decision handed down in the United States Circuit Court, New York, by Judge Lacombe, the

Edison Electric Light Company has been granted a perpetual injunction restraining Albert Hoohester, individually and as manager of the Central Electric Company, from manufacturing or selling a patented improved socket and receptacle for electric lamps. Judge Lacombe held that the defendant had infringed upon the complainant's patent.

The Campbell Electric Supply Company of Boston has been placed in the hands of a receiver.

Suit was commenced in the United States Court at Portland, Ore., on the 10th inst., by the General Electric Company of Schenectady, N. Y., against the La Grande Edison Electric Company of La Grande, to recover on a number of promissory notes assigned to complainant by the Northwest General Electric Company of St. Paul, Minn. The notes were given for electric machinery, and amount in the aggregate to \$5,000.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

GENERAL NEWS.

What is Going On in the Electrical World.

Albany, N. Y.—Among the bills introduced in the Assembly last week were two by Mr. Oliver, one providing for municipal ownership of railroads, surface, elevated or underground, by cities of the first class, and the other providing for municipal ownership of lighting facilities—gas, electric and other.—A bill was introduced in the Assembly compelling all railroad companies in the borough of Manhattan operated by cable or electricity to have two conductors on each car.

Boston, Mass.—The Boston Electric Light Company has entered into a contract with the General Electric Company for the equipment of the generating station now in course of erection at South Boston. The three-phase alternating system will be used. The dynamos will be four in number, each of 3,000 horse power capacity, giving a total output of 12,000 horse power. They will be of the revolving field type, a type adopted to allow of a high voltage being taken directly from the dynamo to the wires without the use of transformers to increase the pressure. The revolving field on each dynamo will be mounted on the shaft of an engine, and the voltage of the generated current will be 2,200 volts. To excite these dynamos two smaller ones, each 100 horse power, will each be driven by a synchronous motor. In addition eighteen large synchronous motors, each of 200 horse power, will drive thirty-six arc-lighting machines. Each motor will be set between two Brush 125-light arc dynamos. Up to the present the Boston Electric Light Company has operated a number of stations throughout Boston. Two of these, however, have recently been abandoned to make way for the new railroad stations now being built, and the company has, therefore, decided to consolidate all the small stations into one large generating plant, to be erected in South Boston.

Burlington, N. J.—The Monmouth Traction Company, which was incorporated a few months since for the building of a trolley road between this city and Keyport, is pushing the work forward, and it is predicted that the road will be in operation in less than a year.

Burlington, Ia.—Articles of incorporation, carrying a capital stock of \$225,000, were filed here a few days ago under the title of the American Investment Company. The object is to control certain electric light and railway interests, gas plants and other enterprises in Burlington. The officers are Col. G. H. Higbee, president; J. W. Walsh, secretary; J. T. Remy, president of the First National Bank, treasurer.

Charlotte, Mich.—Bids are desired for lighting this city for a term of years; plans and specifications may be obtained from the city clerk.

Cincinnati.—The Cincinnati Edison Electric Lighting Company is preparing to erect a new power station corner of Charles and Plum streets. The building will be of brick and stone, 205 by 107 feet, and will cost about \$75,000.

Cleveland, O.—The Big Consolidated Street Railway Company has decided to spend about \$250,000 on improvements in machinery and equipments. A new 2,000 horse power generator and engine and 60 new cars are to be added to the plant.

Coldwater, Mich.—Thomas Duncan and William F. Condon of Saginaw have been granted a three-year franchise to operate a street railway in Coldwater. This road will be extended to Coldwater Lake, twelve miles south of the city, and to points in northern Indiana.

Columbia, S. C.—The House has passed a bill incorporating the Lexington Electric Railway & Electric Power Company of Lexington, S. C. The capital stock of the company is \$25,000 but may be increased to \$100,000. The incorporators are: W. P. Roof, Dr. M. Q. Hendrix, Allen Jones, L. W. Ridd, J. A. Muller, P. H. Nelson, James W. Ogilvie, F. C. Caughman and such other persons as they may associate with them.

Denver, Col.—The "News" says: "Electricity derived from the fall of water will solve the problem of the economic working of mines in one or more districts in Colorado. Before the end of the approaching summer every mine of any prominence as well as an unlimited number of prospects and small shippers in the vicinity of Lake City will be operated by electricity from a central station, construction on which will be commenced at once by a company composed mainly of Standard Oil officials."

Doylestown, Pa.—An agreement has been signed by the Bucks County Railroad Company and the Pennsylvania Railroad Company, giving the trolley company the privilege of laying their rails beneath the bridge of the Trenton Cut-Off Railroad north of Willow Grove. All opposition has thus been removed and the tracks of the trolley road will soon be completed between Doylestown and Willow Grove, making a continuous trolley railway of 25 miles between Doylestown and Philadelphia.—Sheriff Aaron has sold the real estate and personal property of the Provident Electric Light Company of Yardley at public sale to Robert J. Peoples, for \$920. The property includes a line of eight miles of wire and poles and the lamps in Morrisville and Yardley.

El Paso, Tex.—The street railway companies in this city and in Juarez are seriously considering the question of changing the motive power of their roads to electricity. The mule is still the motive power here.

Ellicott City, Md.—The Catonsville Ice, Light & Power Company has purchased the franchises and good will of the Ellicott City Light & Power Company. The plant of the latter company was not included in the sale. The Ellicott City Company has been in operation for five or six years. The Catonsville Company is a new corporation, whose plant is now being constructed, for the purpose of supplying light and power in both Catonsville and Ellicott City and the surrounding territory.

Fargo, N. D.—An ordinance has been introduced in the city council, and received its first reading, granting a twenty-year franchise to an electric street car company. The organization is headed by President Von Niede of the Red River Valley National Bank, and J. B. Lockhart of Fargo, Bob Clendenen and Johnston Wagner of Moorhead and Charles A. Baker of St. Louis. The plan is to operate the line in both Fargo and Moorhead and to secure similar charters in each city.

Gainesville, Ga.—Charles I. Webb is at the head of a company that proposes to establish an electric light plant in this city.

Gonzales, Tex.—Several of the citizens of Gonzales have organized the Citizens' Electric Light & Power Company and have advertised for bids for construction of the same. It will be first-class in every respect. The stock is all taken to the amount of \$8,000 or \$10,000 and work will commence on the plant immediately.

Kokomo, Ind.—The "Dispatch" states that "Superintendent C. L. Harry of the electric light plant has burning in his office a novelty in the way of an electric light. It consists of a small arc lamp, in size that of an incandescent burner, provided with carbon instead of wire, and burns 100 hours. It is supplied from the alternating system and is not adjustable to the street power."

Little Falls, N. Y.—The stock of the United Gas & Electric Companies of this city was transferred to a syndicate of New York capitalists on the 15th inst. A new company was immediately formed, as follows: President, Alexander S. Cochran; secretary, Robert O'Shea; treasurer, Maitland F. Griggs; manager, W. F. Lansing, all of New York except Mr. Lansing. The same syndicate has purchased the stock of the Mohawk and Ilion Gas and Electric Company and the Herkimer plant. It was reported that they were also negotiating for the purchase of the Dolgeville generating plant, but this is denied.

Mt. Clemens, Mich.—An ordinance is to be presented superseding all franchises hitherto granted to the Mt. Clemens & Lakeside Traction Company, so as to meet new conditions arising from the consolidation of that company with the Detroit, Lake Shore & Mt. Clemens Railway.

Morgantown, Pa.—The council has voted to spend \$10,000 to erect an electric light plant.

Newark, N. J.—The Kearny Electric Light & Power Company, which has the franchise for lighting the public streets of Kearny, East Newark and Belleville, and is practically the only competitor of the great corporation known as the People's Electric Light & Power Company of Newark, has, it is stated, been privately sold to parties friendly to or interested in the latter company.

Newport, R. I.—The "News" states that Messrs. Tucker & Anthony of Boston, who conducted the preliminary organization of the Middletown & Portsmouth and Fall River & Stone Bridge railways, are financing the Montville Street Railway Company, which is to build a connecting line of fifteen miles between Norwich and New London, Conn.

Norristown, Pa.—The city council has decided to award the contract for the municipal electric light plant to the Falkenau Engineering Company of Philadelphia. The contract price was \$41,000. There were seven other bidders.

Norfolk, Va.—Ground has been broken for the Portsmouth, Pig Point & Newport News Railroad. It is expected that the railroad will connect with the Port Norfolk Electric Railway for entrance into Portsmouth. It may also connect with the "Belt Line," and thus

transfer truck immediately to the steamship lines in this harbor.

Ocean City, N. J.—The Ocean City Association has purchased the stock of the Water, Electric Light & Sewer Company owned by Superintendent E. B. Lake. The Association has decided to extend the electric railroad to Corson's Inlet.

Ottawa, Can.—The British American Light & Power Company are applying for power to construct and operate by electricity or other power tramways in Dawson City, Fort Selkirk and other points in the Yukon and northern British Columbia; also to operate heating and lighting systems.

Philadelphia.—In the annual report of Chief David Wallace of the Electrical Bureau, just submitted, it is shown that 28,632 feet of conduit and 203,591 feet of duct was laid in 1897. The receipts of the Bureau, principally for licenses on poles, amounted to \$46,304.04. The returns made by the various companies authorized by councils to maintain underground electrical structures, together with those laid by the city, show there has been placed under ground 2,379,388 feet of conduit, an increase of 31,393 feet over 1896, representing an aggregate of 17,675,306 feet of duct.

Pontiac, Mich.—The new syndicate organized by Col. Seymour Brownell of Detroit, which will commence construction of a new electric railway from Detroit to Orchard Lake in the spring, has absorbed the Pontiac & Sylvan Lake Electric Railway, M. B. Mills of Detroit, principal owner of the latter road, becoming a stockholder in the main company. Engineers have begun locating an extension of the line from Sylvan Lake to the military academy at Orchard Lake.

Providence, R. I.—A bill has been introduced in the Rhode Island Legislature authorizing the Middletown & Portsmouth Street Railway Company and the Fall River & Stone Bridge Electric Railway Company to unite and form one corporation to be known as the Newport & Fall River Street Railway Company.

Sac City, Ia.—The citizens at an election held here voted to give a twenty-five year franchise to establish and maintain an electric light plant to a local company comprising Asa Platt, D. Carr Early, Judge S. M. Elwood and others.

Schoolcraft, Mich.—Although the proposition to bond the village for electric lights and waterworks was recently defeated by a failure to secure the necessary two thirds vote, there is still considerable sentiment expressed here in favor of electric lights, and it is probable that a proposition for them alone, without the waterworks, will be voted upon at the spring election.

Shelbyville, Ill.—J. C. Westvelt has been appointed receiver of the electric light plant owned by Trout Bros. & Co. Their liabilities are put at \$9,000, assets at \$12,000.

South Bend, Ind.—Negotiations have been concluded with Pittsburg parties for the purchase of the two car lines in this city. A large sum is to be spent in rehabilitating and extending the systems.

St. Louis.—The North & South Railroad ordinance has passed both the House of Delegates and city council. The bill provides for a 50-year franchise to operate 100 miles of streets in St. Louis, and the lines are permitted to cross and recross the tracks of other street railways and to use their tracks when it is convenient. The vote was 8 to 5 in the council. John H. Blessing is president of the company.—The Board of Public Improvements has sent to the council three bills for city lighting after 1900. One provides for lighting by gas for five years, the city to be divided into six districts. One provides for the lighting by electricity for five years. The third provides for a fifteen-year electric contract. Both of the electric ordinances divide the city into two districts, north and south of Washington ave. The estimate of cost under each ordinance is \$400,000 a year, the amount estimated to be available. Bonds for \$250,000 are required on each bid.

Trenton, N. J.—A bill introduced in the House by Mr. Squier authorizes counties to sell to the highest bidder franchises for trolley roads, the money to be used to improve public roads.

Warren, O.—The American Electric Company's factory will soon be in full operation. This is a new industry in Warren and will furnish employment to over 100 people.

Walla Walla, Wash.—Proposals for electrically lighting streets will be received at the office of the city clerk until March 1. Number of lights from 50 to 100 of 1,200 minimum candle power. Bids to be for three and for five years. Contract to date from November 1, 1898.

Webster, Mass.—The board of selectmen has voted to grant a 50-year franchise to the Webster & Dudley Electric Railway Company, and the company will build an electric road from Perryville in Dudley through streets of Webster to Webster lake.

West Hampton, N. Y.—Word has reached here that the State Railroad Commission has denied the application of the Riverhead, Quogue & Southampton Railroad Company for permission to construct a trolley road between Riverhead and this place, to terminate at the ocean. The application was opposed by the Long Island Railroad Company, on the ground that the company intended to parallel its lines.

White Plains, N. Y.—It is the intention of the Port Chester Electric Railroad Company to extend its line from the northwest terminus in Westchester avenue to the town line of Harrison, at Blind Brook, and thence to this village, through Railroad avenue, to the New

York and Harlem Railroad station. This will connect the latter road with Rye Beach, a favorite summer resort on Long Island Sound.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—The Senate Committee on Railroads has reported favorably the bill of Senator Wilcox amending the railroad laws so as to provide that an electric railway company may become the owner of a lighting system.

Rensselaer, N. Y.—The common council has given the Kinderhook Light & Power Company until March 3 to complete its arrangements for lighting the city. All the material for the Kinderhook Company has arrived. The contract for setting the poles and stringing the wires has been awarded to J. J. Bergen of Troy.

Saratoga, N. Y.—It is reported that the electric road from Saratoga to South Glens Falls, which has been talked of for a long time, is now to be an accomplished fact. New York capitalists have, it is said, agreed to take the bonds, and the money necessary will be forthcoming.

Schenectady, N. Y.—Edward Clark, auditor of the General Electric Company, who recently went South for the benefit of his health, has returned to his home.

PERSONAL AND MISCELLANEA.

Dr. Von Welsbach, inventor of the incandescent gas-burner now very much in vogue, has recently taken out patents on an electric lamp working on a similar plan. He is an Austrian chemist.

The Cincinnati "Enquirer" states that while John W. Baughman, of Williston, Ohio, was in Cincinnati, a few days ago, "he exhibited his latest invention in electricity, that is, the art of using telegraph instruments and electric bells without the use of any batteries whatever." The "Enquirer" says Mr. Baughman uses the earth for battery and expects to be able to light up houses with his new invention as it has been also tested on miniature lamps.

California is well known as the land of flowers, and when the flower fetes take the form of trolley parties they are gorgeous in the extreme and the cars are bedecked with a profusion and elegance that surprise the Eastern visitor. Recently the young ladies in San Jose took charge of a number of street cars on the San Jose & Santa Clara electric line, decorated them with flowers and ran them for the entire day. The motive, of course, was charity, and the sum netted was \$350.

Prof. Elisha Gray, the noted electrician and inventor, who was reported to be dangerously ill at Chicago, has informed his friends that there was some mistake, as he is in good health and not in any danger of dying. His daughter has been seriously ill, and the professor thinks the names have become confused.

James R. Taylor, who died at his home in Brooklyn, N. Y., on the 10th inst., was one of the pioneers in electrical engineering in New York. He was 62 years old.

RECENT COMPANY ELECTIONS.

Albert Lea Electric Company, Albert Lea, Minn.—President, George L. Carrington; secretary, S. H. Cady; treasurer, Harry Jones; directors: G. C. Edwards, Bridgeport, Conn.; S. H. Cady, W. E. Todd, George L. Carrington, Harry Jones, Albert Lea.

Beaver Valley Traction Company, Beaver, Pa.—Directors: John M. Buchanan, John T. Taylor, Dr. Theodore P. Simpson, Robert S. Kennedy, Dr. H. McConnel, John P. Sherwood and Albert M. Kolly.

Chicago Electric Traction Company, Chicago.—President, Jules S. Bache; vice-president, Samuel R. Shipley; treasurer, Henry Lewis; secretary, H. A. Hinsley. The Englewood & Chicago Electric Street Railroad has ceased to exist, the title being transferred to the Chicago Electric Traction Company.

Cumberland Electric Light & Power Company, Nashville, Tenn.—President, T. M. Steger; vice-president, Frederick S. Pratt; secretary and treasurer, Thomas Taylor; general manager, L. J. Webster; directors: T. M. Steger, Frederick S. Pratt, L. J. Webster, C. F. Steirly and Thomas Taylor.

Hagerstown Street Railway Company, Hagerstown, Md.—President, C. W. Lynch; treasurer, William Jennings; secretary, William Hepperle; directors: Christian W. Lynch, William Jennings, Harry Jennings, J. C. Lane, J. G. Bitner, W. C. Hepperle and Martin Hayley.

Hartford Electric Light Company, Hartford, Conn.—President, A. C. Dunham; vice-president, E. B. Bennett; treasurer, D. N. Barney; secretary, D. P. Colton; auditor, George H. Gilman; directors: C. Dunham, Wm. H. Bulkeley, W. G. Burr, Atwood Collins, E. B. Bennett, Henry Roberts, Rodney Dennis, D. N. Barney, E. K. Root, Lucius P. Robinson, W. L. Robb, W. F. Henney.

Lancaster Electric Light, Heat & Power Company, Lancaster, Pa.—President, W. F. Beyer; secretary, George B. Wilson; treasurer, R. H. Brubaker. This company, just organized, has the contract for lighting the streets of Lancaster for five years.

Pittsburg & Suburban Electric Railway Company, Pittsburg, Kan.—President, Morris Cliggett; superintendent, L. G. Gibson; secretary and treasurer, M. O. Dickey.

Rising Sun, Northeast & Elk Neck Electric Railway Company, Elkton, Md.—President, James Mullen; secretary and treasurer, George W. Cosden; manager, L. O. Cameron; directors: James Mullen, George W. Cosden, M. E. Kirk, E. E. Duyekineck, J. M. C. Carhart, Andrew Anderson, L. O. Cameron, Dr. Frank Mackie and William L. Mearns.

Star Electric Company, Binghamton, N. Y.—President

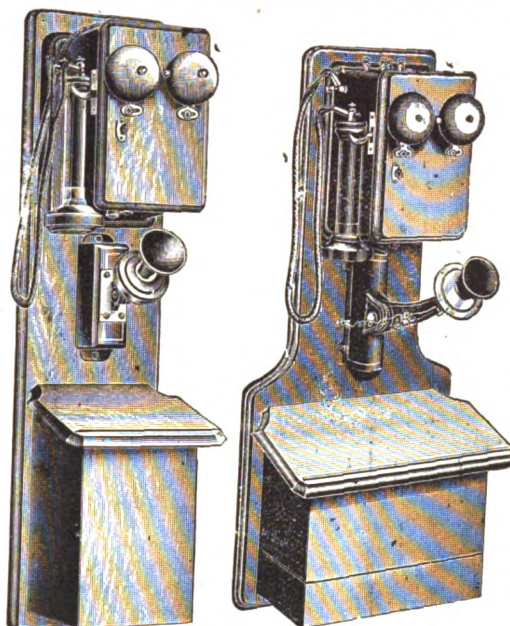
George S. Beach; secretary and general manager, C. E. Beach; treasurer, H. W. Doughty; directors: George S. Beach (to hold office until the first Tuesday in May, 1901), C. E. Beach (ditto 1900), W. H. Doughty (ditto 1899), S. H. Chase (ditto 1898).

Suburban Electric Company, Elizabeth, N. J.—President, A. M. Young; vice-president, Henry Hayes; secretary, A. B. Carlton; treasurer and general manager, E. H. Stevens; directors: A. M. Young, Hon. F. M. Voorhees, Henry Hayes, A. B. Carlton, B. G. Bryan and M. P. Clough.

Wilmington City Railway Company (under the reorganization), Wilmington, Del.—President, Clarence M. Clark; vice-president, E. J. Moore; secretary and treasurer, Thomas S. Beiloh; general manager, Robert F. Fox; directors: C. M. Clark, E. J. Moore, C. Ford Stephens, Thomas C. Barr of Newark, N. J., Preston Lea, E. W. Clark, Jr., William W. Pusey.

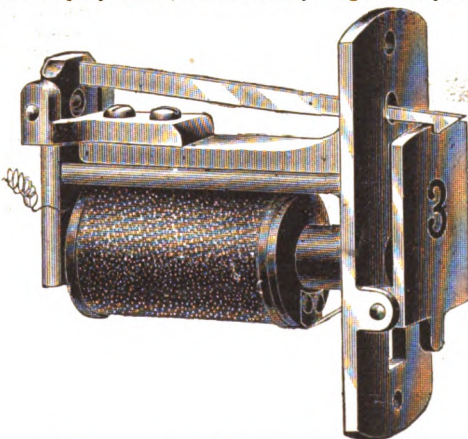
COMMERCIAL PARAGRAPHS.

De Veau & Co., the well-known manufacturers of high-grade telephone apparatus, have recently moved to 27 Rose street, into more spacious and comfortable quarters. The high character of the goods this concern has the reputation of turning out is too well known to require a lengthy description. Their special long-distance telephones, with adjustable arm coal grain ball transmitter, are now extensively used by many independent exchanges throughout the country. The prices of these 'phones range



DEVEAU LONG DISTANCE TELEPHONES.

from \$16 to \$23, depending on the style of generator, which, considering how satisfactory they invariably prove both in construction and operation, are extremely reasonable. This, however, is but one of the numerous apparatuses this company carries, and almost any design of telephone,



THE "B. H. G." SWITCHBOARD DROP.

either transmitter or receiver, can be obtained by addressing the De Veau Company. Besides telephones, a large and choice assortment of special tools, insulators, batteries, electric bells and line material are always on hand ready to be shipped at a moment's notice. We would strongly advise any independent company who either contemplate equipping an exchange or desire to increase the number of their 'phones in use to address De Veau & Co., 27 Rose street, New York.

We are in receipt of an attractive catalogue of some thirty pages lately gotten out by the Ward Leonard Electric Company of Bronxville, N. Y., exclusively devoted to describing various new types of outlet boxes. This well-known company manufactures outlet boxes of every variety, but have made a specialty of porcelain-lined outlet

boxes, which have become a standard for the best practice in electric wiring work in New York City, and are rapidly becoming so in other large cities. The fact that 81,000 of these boxes were installed during 1897 in New York City alone goes to show how highly this type of box is thought of. The catalogue referred to is fully illustrated, and any persons contemplating equipping a building with outlet boxes would do well to address the Ward Leonard Electric Company, for considering the quality of their product their prices are extremely reasonable.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

Business Changes.

The Bissell, Dodge & Erner Co. has for three years maintained a branch office at Columbus, O., where the business has assumed proportions that make it desirable to run it as a separate concern. To do this Mr. John A. Erner has sold his interests in Toledo and purchased the Columbus business entire. Little change will be made in either place except the names, which will be F. Bissell & Co., Toledo, and J. A. Erner & Co., Columbus. The affairs of the Bissell, Dodge & Erner Co. will be closed up at the Toledo office.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Mechanical tell tales for water-tanks, as is well known, have several serious objections, especially if the tank is situated at some distance from the pump. With a view to remedying these defects, Gustave S. Neu, of 147 Centre street, New York, brought out some time ago what is known as Neu's Electrical Tell-Tale Floats, which were especially designed to overcome all the objections that have heretofore presented themselves in devices of this description. The apparatus is simplicity itself and consists in an electrical connection on a tank or reservoir to sound an alarm when the contents are either too high or too low. These floats have many points of superiority, namely, the ease with which they can be put up and the fact of their not rusting or corroding; they can, moreover, be put up for very little money. How well Neu's Tell-Tale Floats answer all requirements is amply proven by their service for the last five years, as well as by the fact that they are extensively used by several automatic sprinkler companies.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

INCORPORATIONS.

The Winsboro Electric Light & Power Company, Winsboro, Wood County, Texas. Capital stock, \$3,000. Incorporators: R. G. Andrews, C. H. Morris, W. T. Whiteman and Manton Jones.

The Triumph Light, Heat & Power Company, Camden, N. J. Capital stock, \$200,000. Incorporators: George A. Banks, R. Linwood Martin, Robert B. Kee and James W. Moore, of Philadelphia, and Alfred J. Lucas, of Gibbsboro, N. J.

The New England Electric Railroad Construction Company, Worcester, Mass. Capital stock, \$25,000. President, E. E. Carpenter; treasurer, H. F. Leland.

The San Angelo Ice & Power Company, San Angelo, Tex.—to sell ice and to manufacture and supply electric light, heat and power. Capital stock, \$30,000. Incorporators: George Bond, George E. Webb, C. H. Powell and others.

The Madison Street Railway Company, Madison, Wis. Capital stock, \$75,000. The filing of the articles presages a reorganization of the company.

The People's Electric Light, Heat & Power Company, Ocean City, N. J. Capital stock, \$50,000. Incorporators: George Pfeiffer, Jr., George Barrett, J. Rufus Eastlack, of Camden, and others.

The Atlas Syndicate Company, Jersey City, N. J.—to survey, build and complete railroads, water, gas or electric works, etc. Capital stock, \$100,000, of which \$1,000 has been paid in. Incorporators: Charles H. Hall of Jersey City and Henry L. Olden and August Graf of New York.

The Atlanta Water Power Company, Atlanta, Ga.—to supply electric power for running electric railways, elec-

TELEPHONE AND TELEGRAPH.

tric light plants and the like for cities and other corporations. Capital stock, \$10,000. Incorporators: Henry B. Wilson, R. H. Smith and O. Elmer Smith.

The Westchester Gas & Electric Company, White Plains, N. Y.—to carry on the manufacture of gas and electric light in the towns and villages of Ely, Port Chester, Mamaroneck, Larchmont, New Rochelle, Harrison and Scarsdale, N. Y., and Greenwich, Conn. Capital stock, \$300,000. Directors: James M. Pendleton of Westbury, R. I., George V. Foster of New York, Arthur L. Chester of Westbury, R. I., Wallace Hackett of Portsmouth, N. H., Herbert T. Jennings of Mount Vernon, N. Y., Paul Armitage of Bay Shore, N. Y., and Henry D. Donnelly of Brooklyn, N. Y.

The Rocky Mount Ice Company, Rocky Mount, N. C.—to construct and maintain cold storage and electric light plants. Capital stock, \$18,000. Incorporators: W. E. Parish and others.

The Empire Light & Power Company of Quincy Ill., has certified to an increase in capital stock from \$60,000 to \$100,000.

Articles of association have been filed for the New Bedford, Middleboro and Brockton (Mass.) Street Railway. Plans include the building of 3½ miles of track to extend from the Marine Park in New Bedford, through Acushnet, Freetown, Lakeville, Middleboro and North Middleboro, to connect at Bridgewater Center with the Brockton, Bridgewater & Taunton Railroad. Capital stock, \$325,000.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 15, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 598,937. Trolley. Charles H. Johnson, Elmhurst, Cal. Filed Oct. 24, 1896.
- 598,947. Track Pond for Electric Railways. Frank T. Mather, Detroit, Mich., assignor of one-half to Alexander S. Tolsma, same place. Filed June 29, 1896. Renewed Dec. 24, 1897.
- 599,081. Insulated Joint for Railroad-Rails. Thomas O'Brien, Jr., Philadelphia, Pa. Filed June 4, 1897.
- 599,162. Electric System of Propulsion. William M. Brown, Johnstown, Pa., assignor to the Johnson Company, Lorain, Ohio. Filed May 18, 1897.
- 599,274. Trolley-Pole for Overhead Electric Railways. J. L. Walker, Louisville, Ky. Filed June 18, 1897.
- 599,307. Trolley-Actuated Switch-Operating Device for Electric Railways. Louis E. Walking, Springfield, Mass., assignor of one-half to Frank W. Dickinson, same place. Filed Aug. 18, 1897.
- 599,281. Fender for Street-Cars. Henry W. Bodeman, San Francisco, Cal., assignor of one-half to M. H. Logan, same place. Filed April 21, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 598,942. Electric-Arc Lamp. George R. Lean, Cleveland, O.; Jotham Potter, administrator of said Lean, deceased, assignor to the Jandus Electric Company, same place. Filed Feb. 20, 1897.
- 599,002. Incandescent Lamp. John T. Lister, Cleveland, O. Filed Oct. 14, 1896. Renewed Jan. 17, 1898.
- 599,052. Electric-Arc Lamp. Charles N. Black, New Haven, Conn., assignor to the Walker Company, Cleveland, O. Filed April 20, 1897.
- 599,121. Electric Gas-Lighting Apparatus. William E. Cram and James H. L. Clegg, Boston, Mass.; said Clegg assignor to said Cram. Filed April 30, 1897.
- 599,305. Electric-Arc Lamp. Christian Tepel, Bennett, Pa., assignor to the Aurora Arc Lamp Manufacturing Company of Pennsylvania. Filed March 10, 1897.
- 579,306. Making Filaments for Electric Lighting. Detlef C. Voss, Boston, Mass. Filed Aug. 3, 1891.

ELECTRICAL MACHINERY AND APPARATUS.

- 598,905. Apparatus for Electrically Measuring Temperatures. Hugh L. Calendar, Montreal, Canada. Filed July 31, 1896.
- 598,922. Automatic Cut-Out for Electrical Converters. William J. Greene, Cedar Rapids, Iowa. Filed Jan. 18, 1896. Renewed May 21, 1897.
- 598,916. Direct-Acting Oscillating Electric Motor. James H. Mason, Brooklyn, N. Y., assignor to John W. Morrison and W. W. Lounsbury, same place. Filed March 24, 1897.
- 598,991. Controller for Electric Motors. Ernst W. G. C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 29, 1897.
- 599,016. Electric Meter. Carl Raab, Kaiserslautern, Germany. Filed Feb. 27, 1896.
- 599,094. Transforming Potential Energy of Carbon into Electrical Energy. Henry Blumenberg, Jr., New York City. Filed April 7, 1896.
- 599,186. Electric Controller. Frank A. Merrick, Auburn-dale, Mass., assignor to the Steel Motor Company, Johnstown, Pa. Filed May 27, 1897.
- 599,220. Electric Alarm Water-Column. Martin L. Bush, Lawrence, Mass., assignor of one-half to Charles F. Swain, Methuen, Mass. Filed June 14, 1897.
- 599,302. Direct-Current Meter. Gustave A. Scheffer, Peoria, Ill., assignor to the Diamond Electric Company, same place. Filed May 7, 1896.

ELECTRIC ELEVATORS.

- 599,015. Electric Elevator. Harold Rowntree, Chicago, Ill., assignor to the Burdett-Rowntree Manufacturing Company, same place. Filed Feb. 28, 1896.

MISCELLANEOUS.

- 598,940. Fusible Cut-Out. James Jones Jr., Brooklyn, N. Y. Filed March 12, 1897.
- 598,918. Electric Battery for Medical Purposes. Carl W. Moessner, Philadelphia, Pa. Filed June 2, 1896.
- 598,972. Tip for Electric Conductors. Alden B. Blodgett, Lowell, Mass., assignor to Charles H. McEvoy, same place. Filed Dec. 22, 1896.
- 599,292. Underground Conduit for Electric Wires. Adelbert L. Daniels, North East, Pa., assignor to the H. B. Camp Company, Aultman, O. Filed Dec. 22, 1897.
- 599,304. Demagnetizing Device. Harry A. Storrs, Burlington, Vt., assignor to the Draper Company, Portland, Me., and Hopedale, Mass. Filed June 18, 1897.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

A Possible Rival of the Bell Company.

The Union Telephone Company, organized at Portland, Me., has filed incorporation papers in that city. The capital stock is \$10,000,000 and the par value of shares \$100. The purposes of the company as set forth in the papers filed are to manufacture, buy, lease and otherwise acquire and dispose of telephones, switchboards and electrical apparatus; also, to acquire, hold and dispose of real-estate, machinery and parts thereof, patterns, patents, inventions, licenses under patents and inventions; to acquire, hold and dispose of the capital stock, bonds and other securities of other corporations, and issue its own bonds and preferred stock. Subscribers to the papers who have paid in the first \$300 are George N. Morton and Frederick H. Gorman of New York, and George A. Beaton of Detroit, Mich. The directors named in the papers are Frederick H. Gorman, George A. Beaton and George N. Morton; president, Frederick H. Gorman; treasurer, George A. Beaton; clerk, Franklin C. Payson of Portland.

A press dispatch from Detroit says: "Hidden behind the Union Telephone Company, organized in Portland, Me., is said to be a promotion company which will have headquarters in New York City and will secure franchises in the Eastern States. Filing of incorporation papers in Portland was said to be merely an evasion of the harsh laws of New York. The fight against the Bell Telephone Company, which gained impetus through the organization of the Detroit Telephone Company last year and consequent competition all over Michigan, will probably be pushed more vigorously by Eastern capital. It is probable that the newly organized promotion company will begin work in New York City at once. Officers of the Detroit company are interested in the proposed New York exchange. George A. Beaton, treasurer of the Eastern company, was formerly secretary to ex-Governor Foraker of Ohio, and is a well-known Ohio politician. He was the promoter of the Detroit Telephone Company, and established several big exchanges in Michigan. As far as possible, it is said, the Union Telephone Company will place the apparatus manufactured by the Detroit Switchboard and Telephone Company in the Eastern exchanges. William L. Holmes, president of the Detroit Company, says the new concern is only a forerunner of a movement more gigantic than anything yet anticipated in this line."

The Central New York Telephone & Telegraph Company re-elected its old officers and directors at the annual meeting. The treasurer's report showed that the gross revenue for the year was \$219,593.77; expenses, \$177,927.84; net revenue, \$41,665.93. Compared with 1896 there was an increase of gross revenue of \$9,328.81, an increase of gross expenses of \$15,270.49, a decrease of net revenue of \$5,941.68. The total number of exchange subscribers is 3,626, a gain of 308 during the year. Dividends were paid during the year to the amount of \$30,000, being at the rate of 6 per cent. on the capital stock.

Edward B. Elliott, chief of the new Electrical Department in Chicago, has, under instructions from Mayor Harrison, notified telegraph, telephone and all other companies using wire communication in the business districts of that city that they must take steps before the 1st of March to bury their wires, otherwise poles will be cut down by the city authorities.

Mr. Wicke has introduced a bill in the Assembly at Albany which provides that in any city of the first class telephone companies shall not charge more than 10 cents for a single message for five minutes and not more than 5 cents for each additional five minutes. The bill is intended evidently to prevent extra charges for telephoning to the annexed portions of the Greater New York.

A new telephone company has been organized at Marietta, Ga., and a charter has been applied for. The city has already granted all the rights asked for. The men named in connection with the enterprise are O. Rex and E. W. Coleman of North Manchester, Ind.; J. L. Clark of Marysville, Tenn.; Col. L. N. Trammell, Walter Sessions, J. N. Gantt and others of Marietta. The name adopted is the Marietta Telephone Company, and the Stromberg-Carlson system will be used.

A card signed by a long list of real-estate dealers and agents, recommending the Kinloch Telephone Company's projected service in St. Louis to the favor of the public, has been published in the local papers. The Kinloch Company's charges range from \$36 to \$60 per annum, and they guarantee as good service as the Bell Company, whose charges are much higher.

The Interstate Telephone Company has asked for a franchise to establish an exchange in Salem, Va. The Bell Company has already an exchange in Salem and a rate war is looked for.

A bill has been introduced in the Virginia Legislature to incorporate the Richmond, Petersburg and Southside Tel-

ephone & Telegraph Company, to operate a telephone line between Richmond and Petersburg, Va. Among the incorporators are W. B. McIlwaine, A. Rosenstock and T. F. Heath.

Owing to the Judge's decision in the Fredonia Hotel case at Washington, denying the guests at hotels the right to use the hotel telephones, four hotels in that city have ordered the Bell Company to take out its telephones. It is thought a general boycott of the company will be organized.

The Cumberland Telephone & Telegraph Company, which has just absorbed the Great Southern Telephone Company, will continue to make Nashville, Tenn., its headquarters. The property brought under the Cumberland Company's control by the deal is valued at \$1,500,000.

The Virginia House has passed a bill incorporating the Atlantic Telephone Company. Governor Tyler has approved the bill incorporating the Grayson Telephone Exchange.

According to recent published statements, since 1880 the American Bell Telephone Company has expended \$2,348,435 in litigation. It costs something to uphold a monopoly and the patrons have to pay it all. The rates are kept up to the requirements of the dividends.

The Central Electric Company of Painesville, O., recently incorporated with a capital stock of \$10,000, will construct and operate telephone lines connecting eastern Ohio cities with Cleveland. The incorporators are: E. L. House, G. C. Steele, C. F. House, E. S. Gravel and E. J. House.

The Austin (Minn.) Telephone Exchange, with all its connections, has been sold to the Northwestern Telephone Exchange Company which already controls the other connections at Austin.

The city council of Columbus, Neb., has granted to the Central Telephone & Electrical Company a franchise to construct and operate a telephone exchange in Columbus. The same company intends to put in exchanges at Fullerton and Albion, Neb.

A Dover, Del., dispatch states that the Diamond State Telephone Company will extend its line to Lewes through Milton.

New Companies Incorporated.

The Farmers' Telephone Company, Perrysville, O. Capital stock, \$3,000.

The Interstate Telephone Company, Ortonville, Minn. Capital stock, \$5,000. Incorporators: A. W. Randall, Peter Bertelson, Fred M. Green, C. W. Schneider, I. O. G. Wall, F. W. Sanborn, C. W. Harrington, E. N. Morrill of Ortonville; John Gold, F. R. Moore and T. E. Forsyth of Big Stone City.

The Mountain Telephone Company, Farlan, Ky.—to establish a telephone system. President, H. Clay; secretary and treasurer, Prof. W. C. Clemens; general manager, John B. Hurst.

The Newport News Mutual Telephone Company, Newport News, Va.—to establish a telephone system. Capital stock, \$10,000. President, M. B. Crowell; secretary, N. O. Watts; treasurer, Isaac Witz.

The Chester County Telegraph & Telephone Company, Oaks, Montgomery County, Pa.—to run lines in Chester, Montgomery, Bucks, Lancaster and Delaware Counties, Pa. Capital stock, \$30,000. Incorporators: Samuel W. Gumbes, Samuel W. Gumbes, Jr., Frank M. Gumbes of Oaks, and Thomas L. Hodge and William D. Barnard of Philadelphia.

Jackson Telephone Company, Cape Girardeau, Mo.—Capital stock, \$2,500. Incorporators: Samuel Hitt, Leo Hart, J. N. Miller and others.

The Ogle County Telephone Company, Rochester, Ill. Capital stock, \$5,000. Incorporators: F. W. Hamlin, John Delancy and A. W. Guest.

The Telephone Construction Company, Jersey City, N. J. Capital stock, \$100,000. Incorporators: George W. Wentz, Spencer Weart and William L. Reer of Jersey City.

The Western New York Telephone Company, Buffalo, N. Y.—to operate a telephone system in Buffalo and in the cities and villages in the counties of Erie, Niagara, Orleans, Genesee, Cattaraugus and Chautauque. Capital stock, \$500,000. Directors: Edward Michael, Henry Koons, Alonzo R. James, Tracy C. Becker, L. F. Wesser, Isadore Michael, W. S. Grattan, Buffalo; E. F. Rankine, S. J. Lawrence, Niagara Falls. The company will probably use the automatic system.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g. gold, guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mgt., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.							PASSENGER RAILWAYS.						
NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.		
		Authoriz'd.	Issued.					Authoriz'd.	Issued.				
Albany, N. Y.—Feb. 19:						Hartford Conn.—Feb. 19:							
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1 1/2% Q., Aug. '97.	133 1/2	Hartford Street Ry. Co.....	100	\$2,000,000	\$200,000	3% S., July, '97.	140		
Troy City Railway Co.....	100	2,000,000	2,000,000	1% Q., Sept. 10, '97.	70	Hartford & West Hartford RR.....	100	1,000,000	247,000	.....	..
Traction Co. (Saratoga).....	100	50,000	50,000	.....	..						
Allentown, Pa.—Feb. 19:						Holyoke Mass.—Feb. 19:							
Allentown & Lehigh Val. Trac. Co.....	.....	4,000,000	1,500,000	.....	80	Holyoke Street Ry. Co.....	100	400,000	400,000	4% A., July, '97.	200
Bridgeport, Conn.—Feb. 19:						Hoboken, N. J.—Feb. 19:							
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1% Aug., '97.	45	North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000	8%, 1892.	70		
Baltimore, Md.—Feb. 19:						Indianapolis, Ind.—Feb. 19:							
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000	5% S., July 2, '97.	59	**Citizens' Passenger Ry.....	.....	5,000,000	5,000,000	.....	25
Baltimore Traction Co.....	25	10,000,000	5,750,000	1 1/2% Q., Jan., '97.	24 1/2								
Central Ry. Co. of Baltimore City...	50	300,000	300,000	6% A., 1897.	80	Lancaster, Pa.—Feb. 19:							
City & Suburban Ry. Co.....	50	4,000,000	4,000,000	2% A., Jan., '97.	48	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	..
Boston, Mass.—Feb. 19:						Lancaster & Col. Electric Ry.....							
New England Street Ry.....	25	5,000,000	1,081,925	1% Q., Jan. 15, '97.	..	West End Street Railway.....	.....	.....	87,500	.....	..
North Shore Traction Co.....	100	4,000,000	4,000,000	3% S., Oct., '96.	14								
North Shore Traction Co.....	100	2,000,000	2,000,000	6% S., A. & O.	78	Louisville, Ky.—Feb. 19:							
West End Street Ry. Co.....	50	10,000,000	9,085,000	4% S., Oct., '97.	84 1/2	Louisville Ry.....	100	4,000,000	4,000,000	1 1/2% A., Apl., '97.	35		
West End Street Ry. Co.....	50	6,400,000	6,400,000	4% S., Oct. 1, '97.	105	Louisville Ry.....	100	2,000,000	2,000,000	2 1/2% S., Apl. 1, '97.	94		
Brooklyn N. Y.—Feb. 21:						Minneapolis, Minn.—Feb. 19:							
Brooklyn City & Newtown Ry.....	100	2,000,000	1,000,000	2 1/2% Aug. 1, 1897.	188	Twin City Rapid Transit.....	100	17,000,000	15,010,000	.....	17 1/2	
Brooklyn Rap. Transit Co., tr. certif.....	100	20,000,000	20,000,000	.....	41 1/2	Twin City Rapid Transit.....	.....	8,000,000	1,137,200	1 1/4% A., Apl., '97.	..
Brooklyn Heights Railroad.....	100	200,000	200,000	.....	..						
Brooklyn City RR.....	100	12,000,000	12,000,000	2 1/2% Q., July, '97.	209	Montreal, Canada.—Feb. 19:							
Brooklyn, Queens Co. & Sub. RR.....	100	2,000,000	2,000,000	.....	..	Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8% S., M. & N.	261
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1% July 1, '97.	150	Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1 1/4% S., J. & J.	99		
Kings County Elevated.....	100	4,750,000	4,750,000	.....	2	Memphis, Tenn.—Feb. 19:						
Kings County Traction Co.....	100	4,500,000	4,500,000	1% July 26, '97	4 3/4	Citizens' Street Railway Co.....	100	1,500,000	1,500,000	.....	15	
Nassau Electric Railroad.....	50	6,000,000	6,000,000	.....	42							
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	74	New Haven, Conn.—Feb. 19:						
Brooklyn, B. & W. E. Railroad.....	100	1,000,000	1,000,000	.....	80	Fair Haven & Westville RR.....	25	1,500,000	900,000	4% S., Sept. '96.	57	
Buffalo, N. Y.—Feb. 19:						New Haven Street Railway Co.....							
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	.....	60	New Haven & Centerville.....	100	1,250,000	1,000,000	2 1/2% A., July '96.	60	
Buffalo Railway Co.....	100	6,000,000	5,870,500	1% Q., Sept., '97.	80 1/2	Winchester Avenue RR.....	25	1,000,000	300,000	.....	40	
Columbus O.—Feb. 19:						New Orleans, La.—Feb. 14:							
Columbus Street Railroad.....	100	8,000,000	8,000,000	1% Q., Feb., '97.	43	Canal & Claiborne RR. Co.....	40	240,000	240,000	2 1/2% S., July, '95.	140		
Columbus Central Street Railroad.....	100	1,500,000	1,500,000	.....	..	New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	1 1/2% Q., Apl., '97.	124 1/2
Charleston, S. C.—Feb. 19:						New Orleans Traction Co.....							
Charleston City Ry. Co.....	50	100,000	100,000	3% S., Jan., '97.	..	New Orleans Traction Co.....	100	5,000,000	5,000,000	.....	2 1/2	
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	..	New Orleans Traction Co.....	100	2,500,000	2,500,000	6% S., J. & J.	..
Chicago, Ill.—Feb. 19:						New Or. City & Lake RR.....							
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3% Q., Sept. 15, '97.	242	Orleans Railroad.....	50	500,000	185,000	1 1/2% S., June, '94.	10 1/2		
Chicago & South Side R. T. RR.....	100	10,823,800	10,823,800	.....	13	St. Charles Street Railway.....	50	1,000,000	1,000,000	1 1/2% S., Apl., '97.	55	
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	37 1/2	New York—Feb. 21:						
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	.....	4 1/2	Central Crostown RR.....	100	600,000	600,000	2% Q., July, '97.	230	
Met. West Side El. const. stik.....	100	15,000,000	15,000,000	.....	25	Christopher & 10th Sts. RR. guar.....	100	650,000	650,000	2% Q., Apl., '97.	155	
North Chicago Street RR.....	100	10,000,000	6,600,000	3% Q., Oct., '97.	225	Dry Dock, E. Brdwy & Battery RR.....	100	1,200,000	1,200,000	1 1/2% Q., Feb., '97.	151 1/2		
North Chicago City RR.....	100	500,000	249,900	.....	..	Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1 1/2% Q., July, '97.	83
South Chicago City Railway.....	100	2,000,000	1,601,200	.....	98 1/2	Bleeker St. & Fulton Fy. Ry. guar.....	100	900,000	900,000	1 1/2% A., July, '97.	205	
West Chicago St. RR. Co.....	100	2,000,000	1,389,000	1 1/2% Q., May, '97.	99	Broadway & Seventh Ave. guar.....	100	2,100,000	2,100,000	2% Q., July, '97.	170		
Chicago West Div. Ry.....	100	1,250,000	624,900	35% S.	..	Cent. Park, N. & E. Rivers RR. guar.....	100	1,800,000	1,800,000	2% Q., July, '97.	820		
Chicago Passenger Ry.....	100	2,000,000	2,000,000	5% S.	..	Eight Avenue RR.....	100	1,000,000	1,000,000	.....	330	
Cincinnati, Ohio.—Feb. 19:						42d St. & Grand St. Ferry RR. guar.....							
Cincinnati Inc. Plane Ry.....	50	1,000,000	575,000	.....	20	Ninth Avenue Rn. guar.....	100	750,000	748,000	4 1/2% Q., Aug., '97.	180	
Cincinnati Inc. Plane Ry.....	50	150,000	150,000	2 1/2% S., Feb., '98.	75	Sixth Avenue RR.....	100	800,000	800,000	.....	105	
Cincinnati, Newport & Cov. St. Ry.....	100	4,000,000	3,800,000	.....	22	Twenty-third St. R. R. Co. guar.....	100	2,000,000	2,000,000	.....	800
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1 1/2% Q., July, '97.	115 1/2	Third Avenue RR.....	100	12,000,000	10,000,000	2% Q., Aug., '97.	160		
Mt. Adams & Eden Park Inc. Ry.....	50	2,500,000	2,200,000	1 1/2% Q., Oct., '96.	..	42d St., Manhattan & St. Nich. Av.....	100	2,500,000	2,500,000	2% Q., Jan., '97.	190		
Cleveland, Ohio.—Feb. 19:						*Union (Huckleberry) Ry.....							
Akron, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000	.....	40	Newark N. J.—Feb. 19:						
Cleveland City Ry.....	100	8,000,000	7,600,000	4% Q., Oct., '97.	59	Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000	.....	47	
Cleveland Electric Ry.....	100	12,000,000	12,000,000	4% Q., Oct., '97.	51 1/2	Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	180	
Detroit, Mich.—Feb. 19:						Rapid Transit Street Ry.....							
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	.....	100 1/2							
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000	5% July, '96.	175	Pittsburg, Pa.—Feb. 19:							
Rapid Railway Co.....	100	250,000	250,000	.....	..	Allegheny Traction Co.....	50	500,000	500,000	.....	43 1/2
Detroit Electric Railway.....	100	1,000,000	1,000,000	.....	100	Consolidated Traction Co.....	50	15,000,000	15,000,000	2% Jan., '95.	14 1/2	
Wyandotte & Detroit River Ry.....	100	250,000	200,000	.....	110	Consolidated Traction Co.....	50	15,000,000	15,000,000	3% May, '97.	..	
Dayton O.—Feb. 19:						Central Traction Co.....							
City Railway Co.....	100	1,500,000	1,470,600	1 1/2% Q., Oct. 1, '96.	100	Citizens' Traction Co.....	50	1,500,000	1,500,000	.....	..
City Railway Co.....	100	600,000	600,000	1 1/2% Q., Oct. 1, '96.	140	Duquesne Traction Co.....	50	8,000,000	8,000,000	6% A.	62		
People's Street Railway.....	100	1,000,000	1,000,000	.....	100	Pittsburg Traction Co.....	50	8,000,000	8,000,000	.....	..
						Federal St. & Pleasant Valley Ry....	25	2,500,000	1,900,000	3% Aug., '95.	..		
						Pgh., Allegheny & Man. Trac. Co.....	25	1,400,000	1,400,000	2 1/2% Q., July, '97.	..		
						Pittsburg & Birmingham Trac. Ry....	50	8,000,000	7,994,839	2% Aug., '95.	..		
						Pittsburg & West End Ry.....	25	3,000,000	3,000,000	1% Q., Jan., '96.	197 1/2		
						Second Avenue Traction Co.....	50	1,500,000	1,500,000	3% A., June 30, '96.	..		
						Suburban Rapid Transit Co.....	50	4,000,000	14,000,000	.....	..

* Unlisted. † Ex div.

a Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h 500 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.

i 100,000 of stock owned by North Chicago Street Railroad Company.

j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

k 85% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; 15% of stock owned by West Chicago Street Railroad Company.

l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.

a Leased to New Orleans Traction Company at 8% on stock.

b Leased to New Orleans Traction Company at 8% on stock.

c Leased to Central Crostown Railroad at 8% on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.

i Leased to Metropolitan Street Railway for 18% on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter.

k Leased to Metropolitan Street Railway for \$145,000 per annum.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authoriz'd Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock. Authoriz'd Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Feb. 19:						Boston, Mass.—Feb. 19:					
Union Street Railway Co.....	100	\$350,000	\$350,000 2 % Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	23,650,000 4 1/2 % Q., Oct., '97	234 1/2	265
Northampton, Mass.—Feb. 19:						Erle Telegraph & Telephone Co.....	100	10,000,000	1 % Q., Aug., '97.	70	70 1/2
Northampton Street Ry.....	100	800,000	225,000 5 % A., July, '97.	165	175	New England Telephone Co.....	100	10,894,600	\$1.25 sh., Q.	134	...
Omaha, Neb.—Feb. 14						New York.—Feb. 21:					
Omaha Street Ry.....	100	5,000,000	5,000,000	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000 1 1/2 % Q.	91	...
Paterson, N. J.—Feb. 19.						*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000 1 1/2 % Q.	105	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	33	35	*Commercial Cable Co.....	100	10,000,000	10,000,000 1 1/2 % Q.	180	190
Providence, R. I.—Feb. 19:						Franklin Teleg. Co..... 2 1/2 % guar.	100	1,000,000	1 % S.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	60	65	Erle Telegraph & Telephone Co.....	100	5,070,000	4,800,000 1 1/2 % Q., Aug., '97.	71	71 1/2
Philadelphia.—Feb. 19.						*Gold & Stock Telg. Co. guar. 6 %	100	5,000,000	1 1/2 % Q.	107 1/2	110
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	2,000,000	14 1/2	..	*International Ocean Tel. Co. guar. 6 %	100	8,000,000	1 1/2 % Q.	108	..
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100 2 1/2 % July 15, '97.	44	45	Mexican Telephone Co.....	100	2,000,000	2,000,000 1 1/2 % Q., July, '97.	150 1/2	151
Hestonville, Man. & Fairmount.....	50	583,900	583,900 3 % S—July 15, '97.	61	65	*Pacific & Atlantic Teleg. guar. 4 %	25	2,000,000	2 % S.	71	76
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000 3 % Feb. 1, '97.	63	66	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000 1 % Q.	..	..
Union Traction Co. \$12 1/2 pd.	50	30,000,000	5,986,095	17	17 1/2	*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525 1 % S.	90	95
aElectric Traction Co.....	50	500,000	8,297,920	71 1/2	71 1/2	*Commercial Union Telegraph Co.....	25	500,000	500,000 8 % S., July 1 '97.	117	119
dCitizens' Passenger Ry.....	50	500,000	192,500 \$3 share Q.	300	..	Western Union Telegraph Co.....	..	97,870,000	1 1/2 % Oct., '97.	90 1/4	91
eFrankford & Southwark Pas. R.	50	1,000,000	1,875,000 \$14 share A—Apr. 97	87 1/2	..	Miscellaneous.—Feb. 19:					
fLombard Avenue Ry. Co.....	25	1,000,000	1,000,000 A. & O.	40	90 1/2	American Dist. Teleg. (Phila.).....	25	400,000	..	14	..
gLombard & South Street Ry.....	25	1,000,000	1,000,000 A. & O.	40	90 1/2	Bell Teleph. Co. (of Canada).....	100	3,168,000	3,168,000 2 % S.	174 1/4	175
hSecond & Third Streets Ry.....	50	1,060,000	771,076 \$9 share A, Mar. 97	260	..	Chesapeake & Potomac Teleg. Co....	100	..	..	61	65
iPeople's Traction Co.....	50	10,000,000	1,600,000 3 % A., April, '97.	..	..	Chicago Telephone Co.....	100	..	..	202	..
jGermantown Passenger Ry.....	50	1,500,000	1,572,800 \$5.25 share—1897.	132	..	Central Dist. Ptg. & Telg. Co. (Phg.)	100	750,000	750,000 .....	..	..
kGreen & Coates Passenger Ry.....	50	500,000	150,000 3 % July, 1897.	132	..	Empire & Bay States Telegraph Co....	..	..	..	72	78
lPeople's Passenger Ry.....	25	1,500,000	740,000 .....	..	..	Hudson River Telephone Co.....	100	2,000,000	2,000,000 1 % Q.	65	66
mPeople's Passenger Ry.....	25	750,000	277,402 .....	..	..	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000 2 1/2 % Q.	112	115
nPhiladelphia Traction Co.....	50	30,000,000	20,000,000 4 % S—Apr. 1, '97.	84 1/2	85	Providence (R. I.) Teleph. Co.....	50	..	..	87 1/2	..
oCatherine & Bainbridge St.....	50	1,000,000	400,000 6 % A—Mar., '97.	..	..	Southern New Eng. Teleph. Co.....	100	8,000,000	..	120	122
pContinental Pass. Ry. guar.	50	1,000,000	580,000 \$6 share—July, '97.	135	145						
qEmpire Passenger Ry. Co.....	50	600,000	600,000 .....	..	..				
rPhiladelphia City Pass. Ry.....	50	1,000,000	475,000 \$7.50 share July '97	176 1/2	180						
sPhiladelphia & Gray's Ry. RR.	50	1,000,000	298,650 \$3.50 share July '97	87	..						
tRidge Avenue Passenger Ry.....	50	750,000	420,000 \$12 share, July '97.	262	..						
uPhiladelphia & Darby Ry. guar.	50	..	200,000 \$2 share July, '97.	..	..				
v17th & 19th Sts. Pass. Ry. guar.	50	..	250,000 1 1/2 % S., July, '97.	157 1/2	..						
wThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000 \$11 sh. A., July, '97	263	..						
xUnion Passenger Ry. Co.....	50	1,500,000	900,000 \$9.50 shre, July '97	225	226						
yWest Philadelphia Pass. Ry.....	50	750,000	750,000 \$10 share, July '97	225	235						
Rochester, N. Y.—Feb. 19:											
Rochester Railway Co.....	100	5,000,000	5,000,000	16 1/2	18						
Reading, Pa.—Feb. 19:											
Reading Traction Co.....	..	1,000,000	1,000,000 Semi-an. Jan. & Jy	10	15						
kCity Passenger Ry.....	50	350,000	350,000 July, '97.	111	..						
lEast Reading Electric Ry.....	50	1,000,000	1,000,000 July, '97.	60	..						
St. Louis Mo.—Feb. 19:											
Fourth Street & Arsenal Ry.....	50	800,000	150,000 .....	..	..				
Jefferson Avenue Ry. Co.....	50	400,000	400,000 2 % Dec., 1888.	..	..				
Lindell Ry.....	100	2,500,000	2,400,000 1 1/4 % July, '97.	124	126						
National Railway Co.....	..	2,500,000	2,479,000 1 1/2 % July, '97.	..	..				
Cass Avenue & Fair Grounds.....	..	2,500,000	2,500,000 .....	..	..				
Citizens' RR.....	100	2,000,000	1,500,000 4 % Oct., '98.	90	110						
St. Louis RR.....	100	2,000,000	2,000,000 2 1/2 % July, '97.	95	105						
Missouri RR.....	50	1,000,000	2,300,000 1 1/2 % July, '97.	170	172 1/2						
People's RR. Co.....	50	500,000	300,000 50c., Dec., '89.	50	52 1/2						
Southern Electric Ry..... 6 % pref.	100	1,000,000	1,000,000 3 % S., Jan., '96.	100	102 1/2						
Southern Electric Ry.....	100	2,500,000	2,500,000	51	53						
St. Louis & Suburban Ry.....	100	4,000,000	4,000,000 3 % A., July, '95.	..	175						
San Francisco, Cal.—Feb.											
California St. Cable RR.....	100	1,000,000	600,000 50c. monthly.	108	109						
Geary Street Park & Ocean RR.....	100	1,000,000	875,000 \$2.50 share, '96.	40	50						
Market Street Ry.....	100	18,750,000	18,750,000 Q., 60c. per share.	53 1/2	..						
Presidio & Ferries RR.....	100	1,000,000	550,000	7	..						
Scranton, Pa.—Feb. 19:											
Scranton Railway Co.....	50	6,000,000	2,500,000	9 1/4	11						
mScranton & Carbondale Trac. Co.	100	500,000	500,000	15	18						
nScranton & Pittston Traction Co.	100	1,050,000	1,050,000	9	11						
Springfield Ill.—Feb. 19											
Springfield Consolidated Ry.....	100	750,000	750,000 .....	..	11						
Springfield O.—Feb. 19:											
Springfield Street Ry.....	100	1,000,000	1,000,000 .....	..	2						
Springfield, Mass.—Feb. 19:											
Springfield Street Ry.....	100	1,200,000	1,000,000 8 % A.	206	210						
Toronto Canada.—Feb. 19:											
Toronto Ry. Co.....	100	6,000,000	6,000,000 1 1/4 % S.	99	99 1/2						
Montreal Street Railway Co.....	100	4,000,000	4,000,000 4 % S.	261	262 1/2						
Washington, D. C.—Feb. 19:											
Belt Ry. Co.....	50	500,000	500,000	70 1/2	..						
Capital Traction Co.....	100	12,000,000	12,000,000 65c. per sh. Oct. 97.	70 1/2	70 3/4						
Columbia Ry. Co.....	50	400,000	400,000 5 1/2 % A.	68	70						
Eckington & Soldiers' Home Ry.....	50	707,000	652,000 .....	..	..				
Georgetown & Tenallytown Ry.....	50	200,000	200,000 .....	..	..				
Metropolitan RR. Co.....	50	1,000,000	437,180 2 1/2 % Q.	121	..						
Worcester, Mass.—Feb. 19:											
*Worcester Traction Co..... com.	100	3,000,000	3,000,000	17	18						
*Worcester Traction Co..... 6 % pfd.	100	2,000,000	2,000,000 3 % S., Sept., '97.	95	97						
Worcester & Suburban Street Ry...	100	550,000	542,500 4 %, 1896.	85	..						
Wilkesbarre, Pa.—Feb. 19:											
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000 1 %, Jan., '97.	24	29						

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to Union Traction Co. at a rental of \$10,000 per an. in 1866-7-8, \$20,000 p. a. in 1879-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10 % guaranteed by Reading Traction Company.
 n Dividend of 6 1/2 % guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Feb. 19:											
Fort Wayne Electric Co.....	25	.....	.....	.....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	34½	35½					
General Electric Co.....	100	10,000,000	4,252,000	3½ % S., July, '98.	90	..					
General Electric Co..... pfd.	100	.....	.....	.....	8½	8¾		
T. H. Elec. Co. T. Secur., Series D.....	50	.....	146,700	.....	24	25			
Westinghouse Elec. & Mfg. Co. com.	50	.....	.....	.....	..	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '97.	54	.....				
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	..	..		
New York.—Feb. 21:											
Edison Elec. Ill'g Co., New York.....	100	10,000,000	7,938,000	.....	133	133½				
*Edison Elec. Ill'g Co., Brooklyn.....	100	4,000,000	3,750,000	1½ % Oct., '97.	110	110½					
Edison Ore Milling Co.....	100	.....	.....	.....	..	..
Edison Electric Storage Co.....	100	.....	.....	.....	..	..
General Electric Co..... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	34½	34½					
General Electric Co..... pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	90	..					
Interior Conduit & Insulation Co....	100	1,000,000	1,000,000	.....	41	..				
United Elec. Lt. & Pow. Co..... pfd	..	.....	.....	.....	..	..
Pittsburg, Pa.—Feb. 19:											
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	..					
East End Electric Light Co.....	50	300,000	300,000	Q	..	10					
Philadelphia, Pa.—Feb. 19:											
Edison Electric Light Co.....	100	2,000,000	.....	.....	144½	..			
*Electric Storage Battery Co..... com.	100	8,500,000	.....	.....	23	24			
*Electric Storage Battery Co..... pfd.	100	5,000,000	.....	.....	29	27½			
*Penna. Ht., Lt. & Pow. Co..... com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	22½	23				
*Penna. Ht., Lt. & Pow. Co..... pfd.	50	5,000,000	.....	6 % Oct., '97.	65½	61				
Northern Elec. Light & Power Co....	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	13½	14					
Southern Elec. Light & Power Co....	10	187,500	187,500	.....	10	..				
Miscellaneous.—Feb. 19:											
Brush Electric Co.....	50	.....	.....	.....	..	..
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	32½	35			
Edison Illg. Co. (St. Louis).....	25	.....	.....	.....	..	15	
Eddy Electric Mfg. Co.....	25	.....	.....	.....	118	125		
Hartford (Conn.) Elec. Light Co....	100	350,000	.....	.....	4	10			
Hartford (Conn.) Lt. & Power Co....	25	175,000	.....	.....	148	..			
New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	.....	82½	86			
Narragansett (Prov., R. I.) Elec. Co.	50	1,200,000	.....	2 % Q., Oct., '96.	114	118				
Rhode Island Elec. Protec. Co.....	50	.....	.....	.....	* 133½	137		
Royal Elec. Co. (Montreal).....	100	.....	.....	2 % Q	* 136½	157½			
Toronto (Canada) Elec. Light Co....	100	1,000,000	.....	1¾ % Q	..	..			
Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	3 % S., Dec. 1, '96.	90	100					
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	..	..

BONDS.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Feb. 19, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co. 1st 5s.	.....	.....	.....	.....	*105¾	106¾
†Interest guar. by Albany Ry. Co. †Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Feb. 19, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 6s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	106	107
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1912	J. & D.	116	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	112	.....
Central Pass. Ry. Co. Cons. mtg. 6s.	601,000	580,000	1932	M. & N.	112	.....
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119¾	121
*151,000 in escrow to retire 1st mtg. bds.						
Boston, Mass.						
Date of Quotation—Feb. 19, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	102	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	.....
*1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston, S. C.						
Date of Quotation—Feb. 19, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Feb. 19, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	103½	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 2d mtg. 6s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. 4½s.	7,571,000	3,781,200	1928	J. & J.	.....	55
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	52
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	101½	.....
North Chicago St. RR. Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....
North Chicago City Ry. Consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103½	.....
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	105½
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	94½	94½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101½	.....
†Redeemable at option on 60 da. notice. †Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. †Subject to call after Oct. 1, 1899, at \$110 and interest. †Assumed by W. Chi. RR. Co., lessee. †Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—Feb. 19, 1898.						
Cin. New. & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126½	.....
†Assumed by the Cin. St. Ry. Co. †250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—Feb. 19, 1898.						
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,219,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	106½	107½
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	90	95
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	100	102
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....
*11,900,000 in escrow to retire bonds of absorbed companies, marked a. *Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Feb. 19, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	.....	99
Ft. Wayne & Belle Isle Ry. 1st mtg. 5s.	400,000	877,000	1902	A. & O.	.....	98½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	98½	99½
*11,150,000 in escrow to retire bonds of Del. City Ry. and Grand River St. Ry.						
New Haven, Conn.						
Date of Quotation—Feb. 19, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	104	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	104	.....
Winchester Avenue RR. Deben. g. 6s.	100,000	94,000	1909	M. & S.	102	.....

*With interest. *Unlisted.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—Feb. 14, 1898.						
Canal & Claiborne RR.....1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	....
Crescent City RR.....1st mtg. 6s.	.....	50,000	1899	M. & N.	100	....
Crescent City RR.....Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	72½	....
New Orleans City RR.....1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	110
N. Or'l's City & Lake RR.....1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	108	....
Orleans Railroad Co.....Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	91½	99
St. Charles St. RR. Co.....1st mtg. 6s.	300,000	75,000	1906	J. & D.	103	....
†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
†\$90,000 outstanding.						
New York.						
Date of Quotation—Feb. 19, 1898.						
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	108	110
Atlantic Av. (Brooklyn)....Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	105	106
Bro'dway & 7th Ave.....1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Bro'dway & 7th Ave.....1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105½	108
Bro'dway & 7th Ave.....2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Bro'dway Surface.....1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	....
Bro'dway Surface.....2d mtg. 5s.	1,000,000	1,000,000	1905	.....	*107	....
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	117
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	90
Brooklyn Heights RR.....1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	....
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	107	108
Brooklyn, Q's Co. & Sub'n. 1st cons. mtg. 5s.	4,500,000	2,750,000	1941	M. & N.	80	....
Brooklyn Rapid Transit.....gold 5s.	7,000,000	5,181,000	1945	.....	96	....
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	105	108
Cent P'k. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crosstown RR.....1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	300,000	1903	J. & J.	104	105
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. gen. scrip 5%.	1,100,000	1,100,000	1914	F. & A.	97	*101
Eighty Ave. RR. Co.....Cert. indebt. 6½	1,000,000	1,000,000	1914	F. & A.	100	....
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	118
42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	....
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1937	F. & A.	113½	110
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	101	105
Steinway Ry. (L. I.).....1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co.....1st mtg. 5s.	350,000	350,000	1919	.....	102	107
Third Avenue RR.....1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125
Twenty-third Street Ry.....1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry.....Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
†\$1,035,000 in escrow to retire gen. mtg. bonds.						
†\$4,850,000 in escrow to retire maturing obligations.						
†\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
†In treasury, \$80,000.						
†Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Feb. 19, 1898.						
Montreal St. Ry.....1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
Toronto St. Ry.....1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
†\$35,000 per m. single track authorized.						
\$600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—Feb. 19, 1898.						
Continental Pass. Ry.....1st mtg. 6s.	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry.....1st mtg. 7s.	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry.....1st mtg. 6s.	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry.....1st mtg. 6s.	150,000	.....	1901	.....	....	....
People's Pass. Ry.....1st mtg. 7s.	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....2d mtg. 5s.	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.....Cons. mtg. 5s.	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.....Stk. tra. cert. g. 4s.	5,698,210	.....	1943	.....	102	....
Phila. City Passenger Ry.....1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	....
Philadelphia Traction Co.....Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105
Thirteenth & 15th St. Ry.....1st mtg. 7s.	100,000	100,000	1903	A. & O.	....	....
Union Passenger Ry.....1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
Union Traction Co.....Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry.....1st mtg. 7s.	.....	.....	1905	.....	....	....
West Phila. Pass. Ry.....1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115½	....
West Phila. Pass. Ry.....2d mtg. 5s.	750,000	750,000	1926	M. & N.	114½	115
‡ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Feb. 19, 1898.						
Birmingham, Knox & Allentown.....6s.	500,000	500,060	1931	M. & S.	....	95
Central Traction Co.....1st mtg. 5s.	375,000	375,000	1930	J. & J.	....	....
Citizens' Traction Co.....1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115¾	116½
Duquesne Traction Co.....1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	110	....
Fed'l St. & Pleasant Valley.....5s.	50,000	50,000	1913	J. & J.	107½	....
Fed'l St. & Pleasant Valley.....Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	....	....
Millvale, Etna & Sharpsburg.....5s.	750,000	750,000	1923	M. & N.	106½	....
Pittsburg, Crafon & Mansfield.....5s.	250,000	250,000	1924	J. & J.	105½	....
Pittsburg Traction Co.....1st mtg. 5s.	750,000	750,000	1927	A. & O.	....	....
Pittsburg & Birmingham.....1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	105¾
Pittsburg & West End.....1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
Pg'h. Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,930	1980	A. & O.	111	....
Second Ave. Traction Co.....5s.	2,500,000	2,000,000	1934	J. & D.	....	114
Sub. Rapid Transit Railway Co.....6s.	500,000	500,000	1913	M. & S.	....	....
Providence R. I.						
Date of Quotation—Feb. 19, 1898.						
Newport Street Ry.....Coupon 5s.	50,000	.....	.....	.....	.....	.....
United Trac. & Elec. Co.....1st mtg. g. 5s.	9,000,000	50,000	1910	J. & D.	....	....
St. Louis.						
Date of Quotation—Feb. 19, 1898.						
Baden & St. Louis RR.....1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	102
Mass Ave. & Fair Gds. Ry.....1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102½	103½
Titens's Railway Co.....1st mtg. 6s.	2,000,000	4,500,000	1907	J. & J.	107½	108½
Comp. H'ts., Un. De. & Mer. Ter.....1st 5s.	1,000,000	1,000,000	1907	J. & J.	107½	108½

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Feb. 19, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	100½	107½
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co.....1st mtg. 6s.	400,000	300,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	300,000	300,000	.....	.....	60	64
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	111	112
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. vds.						
San Francisco Cal.						
Date of Quotation—Feb., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	.....
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	3,000,000	1913	J. & J.	128	129½
†Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	109½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Feb. 19, 1898.						
Belt Ry. Co.....O.....1st mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	.....
Eckington & Soldiers' Home Ry.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Feb. 19, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	111	112
†Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	70	75
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	108½	109½
†Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95½	98
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	103
†Crosstown St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	95	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	93	97
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	98	97
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	113	113½
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	92	94
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	118	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	*98	99
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
††\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 reserved to redeem prior liens.						
††\$620,000 in escrow.						
*With interest						

*With Int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Feb. 19, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	Quar.	154	.....	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	100 1/2	.....	.....
Pittsburg, Pa.						
Date of Quotation—Feb. 19, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light..... 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Feb. 19, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	111	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,176,000	1903	.....	113	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia)...	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q. ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Feb. 19, 1898.						
American Bell Telephone..... 7s.	.....	.....	1898	F. & A.	100 1/2	104
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108 1/2	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108 1/2	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Feb. 19, 1898.						
American Electric Heating..... 5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. 5s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 10s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	77,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10 1/2 @ 10 3/4 c.; Lake, 10 1/2 @ 11 c.; casting, 10 1/2 @ 11 c.

Interest upon the scrip of the Westinghouse Electric & Manufacturing Company to March 1 will be paid to holders of record on that date.

The Third Avenue Railroad Company, New York, has declared a quarterly dividend of 2 per cent., payable February 28. Books will reopen March 1.

The net earnings of the Edison Electric Illuminating Company of New York for the month of January were \$298,307 as against \$240,299 in January, 1897.

Senator Wilcox's bill, amending the laws in relation to the powers of electric light and power corporations by allowing extensions beyond city limits was passed in the New York Senate on the 17th inst.

The Syracuse (N. Y.) Rapid Transit Railway Company offers through E. C. Jones Company and Townsend, Whelen & Co., a new issue of \$1,250,000 first mortgage 5 per cent. fifty-year gold bonds at 101 and interest.

In the suit of Carrie E. Read against the Brooklyn Heights Railroad Company, Brooklyn, N. Y., for the loss of her husband, John J. Read, killed in a trolley accident, the jury has brought in a verdict of \$25,000, the largest in a death case ever recorded in Brooklyn.

The Edison Electric Illuminating Company of New York has voted to increase its capital stock by 15 per cent., offering the additional amount to present stockholders at par. Payment is required in three equal installments—on March 10, May 2 and August 2. The new stock does not carry interest or dividends until fully paid.

The Detroit Telephone Company has put on the market \$100,000 worth of 25-year gold bonds, bearing interest at 6 per cent. The mortgage on the franchise, conduits and apparatus of the Detroit Telephone Company, which secures the bonds, authorizes the sale of \$600,000 worth of bonds on a plant of 5,000 telephones. The Central Trust Company of New York is trustee.

Mr. Lauterbach, counsel of the Third Avenue Railroad, New York, states emphatically that there is no foundation for the rumor that a working arrangement between the Metropolitan Street Railway Company and the Third Avenue Company was in contemplation. He says: "Such a project has never been suggested or considered, and there is not the slightest shadow of probability that it ever will be."

An order of sale has been made by United States Circuit Judge William H. Taft at Cincinnati to dispose of the property owned by the Cincinnati Inclined Plane Railway Company, known as the Main Street Electric line. The sale is ordered on a petition in foreclosure made by the Louisville Trust Company. Mr. Philip B. Spence of Newport, Ky., has been appointed special master commissioner to make the sale.

The issue of \$2,000,000 of Chicago Passenger Consolidated 5 per cent. bonds has been listed on the Chicago Stock Exchange. The bonds were issued some months ago for the purpose of refunding old 6 per cents and paying off the floating indebtedness of the Chicago Passenger to the West Chicago Street Railroad. The Passenger Company by means of the issue was enabled to fund all its outstanding floating obligations.

The semi-annual statement of the United Electric Securities Company, Boston, for the six months ended February 1, 1898, is issued. Of the \$8,000,000 collateral trust 5s sold \$1,207,000 have been retired and cancelled from the proceeds of the sale of \$4,631,500 of underlying bonds pledged as security therefor. The price at which the collateral 5s have been redeemed is about 3.213 per cent. over the subscription price. The sales of the underlying bonds have been made at an average price of about 87.63.

The Knickerbocker Telephone & Telegraph Company has been incorporated with a capital of \$7,500,000 to construct and operate lines of telephone from New York City throughout New York State and New Jersey. The directors are Samuel B. Lawrence, Francis P. Lowery and Charles L. Horton of Manhattan Borough (New York), and John B. Summerfield, Henry M. Haviland, George E. Spencer and Henry E. Everdell of Brooklyn Borough. The company paid into the State Treasury at Albany an organization tax of \$9,375.

A trust deed has been filed in the register's office at Knoxville, Tenn., by the Knoxville Electric Light & Power Company to the Union Trust Company of Philadelphia, authorizing an issue of \$100,000 of bonds that will bear interest at the rate of 5 per cent., the principal and interest being payable in gold. The instrument states that \$50,000 of the issue shall be used in the payment of outstanding bonds of the company. Further, that \$50,000 shall be used in the payment of the issue of bonds of the Schuyler Electric Light & Power Company.

The personal property of the Home Telephone Company was sold at sheriff's sale at Pittsburg, Pa., on the 17th inst., to C. E. Phelps & Co., of Baltimore, for use of Martin Meyerdeick, for \$100. Phelps & Co. issued an execution against the company in December for \$16,190.03. The assets of the company consisted of the poles it had erected and the conduits that were placed in the streets, and the office furniture of the company. The company had expended over \$70,000 in Pittsburg to supply cheap telephones.

A bill has been introduced in the New York Assembly incorporating Eugene Treadwell, Nathan Ottinger, Herman J. Katz, B. Franklin de Freece and Edgar M. Johnson as the New York Water & Electric Power Company, with principal office in New York City. The capital is fixed at \$100,000, with privilege to increase it to \$25,000,000. The purposes of the corporation will be the storage, transmission, sale and use of water for the generation of hydraulic power and other forms of force and energy capable of being derived therefrom, especially electricity, and for the purposes of manufacturing, mining or agriculture, and the transmission, supply, distribution and sale of such power or powers to the various civil divisions of the State for commercial, manufacturing, propelling, navigating and other purposes.

Formal announcement was made on the 15th inst. that a controlling interest in the stock of all the independent electric light companies of Philadelphia had been acquired by the Pennsylvania Manufacturing Light & Power Company, incorporated under the laws of New Jersey, with a capital of \$15,000,000. The announcement was made by Martin Maloney, president of the Pennsylvania Heat, Light & Power Company, which absorbed the local Edison company through the medium of a collateral trust two years ago. The new company will issue \$15,000,000 collateral 5 per cent. gold bonds in exchange for the stock of the minor companies. No organization of the new \$15,000,000 enterprise has been effected yet, but Martin Maloney will undoubtedly be made president.

The Massachusetts Railroad Commissioners' report, issued last week, contains the annual reports of 93 street railways for the year ending September 30, 1897. The aggregate gross receipts of these roads were \$15,898,839; operating expenses, \$10,904,040; net, \$4,994,799; charges, \$2,401,652; balance, \$2,593,147; dividends, \$1,965,243; surplus, \$627,904. The figures for the same period in 1896 were: Gross receipts, \$14,900,942; operating expenses, \$10,563,371; net, \$4,337,571; charges, \$2,056,795; balance, \$2,280,776; dividends, \$1,802,847; surplus, \$477,929. The gross assets of the companies in 1897 were \$67,509,916; gross liabilities, \$66,483,414; surplus, \$1,026,502. The Commissioners' report includes the reports of ten more roads than were in operation in 1896. Main track constructed during the year amounted to 137 miles, making a total of 1,517 miles, of which only 12 miles are operated by horses. The total number of passengers carried is 308,654,224, an increase of 16,325,281.

ELECTRICITY.

Vol. XIV.

NEW YORK, MARCH 2, 1898.

No. 8.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUMPS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	113-114
Submarine Mines and Electricity.	
The Diesel Motor.	
Electro-Metallurgical Industries.	
Under the Searchlight,	114
Do They Keep a Buffet There?	
The Value of Their Contracts.	
The Last Application.	
The Measurement of Insulator Resistances by Alternating Currents,	115
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XV.—The Hargreaves-Bird Alkali Process. By J. B. C. Kershaw, F. I. C.,	116
A Survey of the Possibilities of Electric Heating and Cooking. By W. P. Adams, A. I. E. E.,	117
Standard System of Electrical Diagrams,	118
An Electrolytic Process for the Manufacture of Parabolic Reflectors. By Sherard Cowper-Coles,	119
A May Meeting of Street Car Men in Chicago, - London Notes,	120
Dr Lodge on Coherees.	
The Next Meeting of the N. E. L. Association, - Street Railways in Massachusetts,	120
American Institute of Electrical Engineers, - Joint International Meeting at Laredo, Tex.,	121
Legal Notes,	121
The News,	121
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous	
Recent Company Elections,	123
Commercial Paragraphs,	123
Incorporations,	123
Electrical Patent Record,	124
Telephone and Telegraph,	124
Electrical Securities—Stocks, Bonds, Etc.,	125
Notes for Investors,	125

EDITORIAL NOTES.

Submarine Mines and Electricity.

Electricity as a means of controlling the engines of war plays an important part. This is especially the case with submarine mines

and torpedoes which are kept under thorough control and made to act at the proper time through the influence of the electric current. Submarine mines have been extensively used in modern warfare, notably during the civil war in this country and during the Franco-Prussian conflict. The last decade, however, has seen extensive improvements in the method of firing mines due to the rapid development of electricity.

Probably the simplest form of mine, and the one most extensively used until electricity came into general use, was that known as the contact mine, which consisted of an iron case containing an explosive attached to a cable, the latter having its lower extremity fastened to an anchor of some sort. The iron case was provided with a number of firing pins, any one of which being brought in contact with the hull of a ship fired a percussion cap and exploded the charge. As will readily be seen, these contact mines are not in any way under control, and were equally dangerous to friend and foe. With a view to remedying this evil, what is known as the electro-contact mine was invented. In this device the firing pins on the case containing the explosive, instead of exploding a percussion cap when brought in contact with an object, act as a switch by closing one opening in an electric circuit. Another switch is located in this same circuit at a station on shore, so that in order to fire the mine it is necessary to close the land switch at the same time that one of the pins has been driven in by the hull of a vessel. If this is not done no explosion takes place, which enables friendly vessels to pass in and out without fear of accidentally running foul of a mine and being blown up, as would be the case with the ordinary form of contact mine.

Numerous electrical inventions have been patented from time to time for controlling and firing submarine mines. One of these inventions consists in an ingenious arrangement for holding a mine down near the bed of a bay or other body of water, to enable friendly vessels to pass over it in safety. The device consists in a loop fastened to the anchor and to a point on the cable near the mine. In a hollow opening in this loop a small charge of an explosive is placed which can be fired from the shore by means of a spark from an electric battery. In bursting, the loop is destroyed and the mine immediately rises the full length of its cable and to within a few feet of the surface. The mine itself may then be fired from the shore in the ordinary manner.

In deep water, or where a strong current exists,

recourse is had to what is known as ground mines. These consist of large charges of gun cotton or other high explosive held in or near the ground by means of mushroom anchors. Mines of this character being too far below the surface to be fired by coming in contact with the hulls of vessels, arrangement has to be made to ascertain exactly when a vessel is over a mine in order to know when to fire it. This is accomplished by a very simple method, although an extremely ingenious one. An electric circuit extends from the mine to two stations on land at no great distance from one another. At each of these stations a break occurs in the electric circuit, and in order to explode the mine both of these breaks must be closed simultaneously. A telescope is mounted at each station on a pivot, which permits of its being swung in a horizontal direction, and so arranged that when pointed at the mine it closes the circuit at that station. Thus all that is necessary to do is to keep both telescopes pointed at an enemy's vessel as it advances, and when the latter passes over the mine both switches will be closed, the circuit completed and the mine exploded.

Innumerable other devices have been brought out, in which electricity invariably plays an important part, for carrying on warfare of this nature. What is known as the observation mine, an improvement over the electro-contact mine, is one of these. In a mine of this character the firing mechanism and the explosive are in two distinct and separate receptacles, placed one above the other on a cable. The contact buoy which contains the firing pins floats a few feet below the surface of the water, the mine itself being located several feet below it. With mines of this description there are always two separate and distinct electrical circuits leading to the shore. One is known as the firing circuit, while the other, in circuit with the firing pins on the upper receptacle, rings a bell at the shore station whenever one of the pins is driven in by coming in contact with an object. Mines of this description are usually placed in groups, all the wires being brought together at a switchboard at the firing station. An operator stands ready at hand, and as soon as a bell rings the switch corresponding to that bell is closed and the mine exploded.

The advantage of the observation mine is that, contrary to what its name implies, no observations have to be taken to locate the position of an enemy. The operator, in a bombproof chamber underground, simply watches the switchboard and awaits a signal.

It is the aim and ambition of inventors to devise some means of exploding a torpedo charge or a mine at a considerable distance by electricity without any intermediate connection such as wires. Possibly an arrangement of this nature will be forthcoming in the future, worked on somewhat the same principle as Marconi's wireless telegraphy, by means of Hertzian waves.

The Diesel Motor.

We are living now in what might justly be termed an age of progress. During the last half century many important and valuable inventions have appeared and most of the machinery and apparatus then in use has since been developed and brought to a high state of efficiency. Probably the machine that has been least affected by the onward march of progress is the steam engine. This prime mover is now practically in the same comparatively crude state that it was fifty years ago, if we except possibly a few minor improvements tending to make the machine more compact and to facilitate the cleaning and oiling. As far as the efficiency is concerned, it still leaves much to be desired, the modern stationary steam engine wasting, as is well known, in the neighborhood of 87 per cent. of the energy in the coal. One cannot help but be forcibly impressed with the difference between an efficiency of 13 per cent. in the steam engine and the high efficiency of 96 to 97 per cent. in electrical machines that manufacturers of the latter are willing to guarantee.

At the present time there is said to be a prime mover under construction in St. Louis that will show a marked improvement as far as efficiency is concerned over our present stationary steam engines. This motor was perfected a short time ago by Mr. Diesel in Germany and is now being manufactured under patents granted to the inventor. From numerous tests that have been made it is claimed that the Diesel motor has an efficiency of from 25 to 30 per cent., or more than twice the efficiency of our steam engines. The fuel used is petroleum, of a low grade of lamp oil, the amount consumed varying from .48 pound to .55 pound per horse power. The process for converting the heat energy of the fuel into work consists in compressing air to a degree producing a temperature above the igniting point of the fuel which is to be consumed, then gradually allowing the fuel for combustion to mix with the compressed air while expanding against a resistance sufficient to prevent an essential increase of temperature and pressure, then shutting off the supply of fuel and allowing further expansion to take place without transfer of heat.

In the Diesel motor cylinder condensation is reduced to a minimum or entirely avoided by using only permanent gases as the vehicle of the expansive force of heat. There is naturally less loss of heat to the cylinder walls, owing to the fact that the gases used have less conducting power than steam. The sudden blow on the piston which frequently occurs in the steam engine as shown by indicator diagrams is said to be entirely avoided in the Diesel motor. In the latter there is less than 7 per cent. clearance, and even this small space is filled with compressed air to a pressure of 500 pounds at an exceedingly high temperature. Petroleum is slowly and gradually injected into the space previously mentioned during a predetermined part of the stroke by means of compressed air, compressed by a separate pump to a higher pressure than that in the working cylinder. The result is claimed to be a gradual and complete combustion resulting in a noiseless and odorless exhaust.

In appearance the motor much resembles a vertical marine steam engine. The main cylinder and air pump are both single acting. The cylinder heads as well as the cylinder are water jacketed. When the engine is in operation a small reservoir is kept supplied by the air pump to a pressure of about three atmospheres higher than that in the main cylinder. This air is used for injecting the petroleum while the engine is working, and also for starting. When running, this engine is said to require little or no attention except to see that the oil cups are kept filled. The oiling of the main cylinder and of the air pump is done under pressure, the oil being forced in on the level of the lowest position of the upper packing ring.

The engine which is now being constructed in St. Louis will be of sixty horse-power, and will more-

over be the first that has ever been built in this country. A small Diesel motor is said to be on its way from Germany to New York City, where it will be used for running a dynamo at the Electrical Exhibition which is to be held in Madison Square Garden in May.

From the tests that have been made abroad it appears as though Mr. Diesel's invention was destined to fill a long felt want, for there would seem to be little use in striving to increase the efficiency of dynamos and motors by a fractional per cent. when such a large percentage of the energy of fuel is lost at the very start in the prime mover. With an efficiency of 25 to 30 per cent., as is claimed for the Diesel motor, the cost of fuel in an electric lighting plant, for instance, would be reduced by one-half or more, which should mean cheaper light for the consumers.

Although the Diesel motor would seem to be a step in the right direction, it is by no means an ideal machine as yet, for no apparatus can be looked upon as ideal that wastes 70 to 75 per cent. of the energy transmitted to it. It is gratifying to observe, however, that this difficult problem has been grappled with and partly solved, and undoubtedly it will not be many years before a prime mover makes its appearance that will have an efficiency in keeping with that of our electrical apparatus now in general use.

Electro-Metallurgical Industries.

processes as have met with the greatest success abroad. His various contributions that have appeared in *ELECTRICITY* from time to time on electrolytic soda and bleach, on the Siemens & Halske gold recovery processes, and on the extraction of zinc from its ores, have been valuable additions to the literature on these subjects.

In this issue appears an illustrated article by Mr. Kershaw, describing in detail the Hargreaves-Bird process of producing alkali and the results that have been attained after two years' experimental work at Farnworth, where the plant is located. The experiments were carried on with a view to determining the most suitable size for the electrolytic cells, and to ascertain exactly the proper method of working previous to the construction of a larger plant, to be located at Cheshire, for the production of alkali on a large commercial scale.

It is universally acknowledged that in certain of the electrolytic processes Europe, especially England and Germany, is far in advance of the United States. On the other hand, in the electrolytic production of copper this country is in advance of Europe, and turns out more copper by means of electricity than all the countries of Europe combined. Although processes for the deposition of metals have been known for many years, electro-metallurgy has made rapid progress only during the last decade. Up to ten or twelve years ago the attempts to produce or separate substances by electrical processes were mostly in the way of experiments, but it is these investigations that have paved the way for the flourishing industries in this line that exist to day. It can truthfully be said that at the present time there is no metal that cannot be deposited electrolytically, if we except possibly lead, and even this refractory substance can be deposited under certain conditions. As is well known, electro-deposition is exceedingly useful and can be advantageously applied to a variety of purposes, as for instance, goldsmith work, statuary and sculpture. Zinc can now be extracted from its ores electrolytically, and, as Mr. Kershaw has pointed out, there are establishments in Germany where electro-deposition of zinc is effected. In England the Cowper-Coles process, so ably described by Mr. Kershaw in a recent issue of *ELECTRICITY*, is employed to deposit zinc on hulls of ships, especially torpedo boats.

In the United States the first plant for the refining of copper by electricity was built some ten years ago by Edward Balbach at Newark, N. J. At that time the plant just mentioned and a plant shortly afterwards erected at Bridgeport, Conn., were the only large electrolytic plants in this country. To show the rapid progress that has been made in this industry, it is only necessary to state that at the present time we have eleven electrolytic refineries, which produce in the aggregate about 124,000 tons of copper annually, or almost five times the amount that is produced in the same way in Europe.

An excellent idea of the growth of this branch of industry in this country can be obtained by referring to Mr. Kershaw's article on the electrolytic copper industry which appeared in our issue of November 17, 1897, in which the production of copper for the four years previous to and including 1896 is given. In 1893 this country is said to have produced 37,503 tons of electrolytic copper; in 1894, 57,500 tons; in 1895, 87,000 tons, and in 1896, 124,000 tons. During this same period Europe produced but a total of 100,000 tons, or 25,000 tons a year.

Although it has been known for many years that potassium cyanide was a solvent of gold, it is only recently that processes of this nature have been tried on anything like an industrial scale.

According to Mr. Kershaw, potassium cyanide processes for the recovery of gold have not as yet been attempted upon an industrial scale in abroad, so that it would seem that even in this branch of electro-chemistry we are in advance of Europe, as several processes of this nature have already been worked successfully in western portions of this country. A plant located at Metal Creek, Cal., and known as the Shasta Gold Extraction Company's, is said to have been operated successfully as long as the local ores lasted. Another company was formed some time ago at Denver, Col., known as the General Gold Extracting Company, which operated for some time under United States patents based on the Pelatan-Clerici process, a process that apparently differs only slightly from that of Siemens & Halske, and which consists of a treatment of the crushed ore by agitation in a dilute solution of potassium cyanide by means of an electric current.

The electro-metallurgical industry may be said to be in its infancy, better arrangement of apparatuses being constantly devised and processes perfected. Mr. Kershaw's articles, describing in detail the various processes which are now being tried in Europe, and the results obtained so far are extremely valuable as furnishing a means of comparison between the progress that has been made abroad and in this country. It is further extremely gratifying to observe that we in no wise suffer by this comparison.

Under the Searchlight.

Notes and Comments on Various Topics.

In one of the daily papers Mr. Thomas A. Edison is credited with the following statement:

There is only one "scope," and that is the kinetoscope; only one "graph," and that is the projectograph. All others are piratical imitations. I shall drive them out of the field, taking no prisoners and showing no quarter.

* * *

Do They Keep a Buffet There?

(From the Boston Advertiser.)

A traveling man who sells supplies to the General Electric Company says that it is a veritable tonic to visit the works of the company at Schenectady. There is a steady rush of work and the business is being done at a profit. As he expressed it, the company "has money to burn," and the signs of prosperity are plainly to be found everywhere.

As the stockholders of the G. E. Company must necessarily be very much run down in health awaiting dividends that have been constantly hinted at by the various booming agencies of the company, it might be well for them to visit the works and get

some of the tonic referred to in the above paragraph. They should certainly avail themselves of this opportunity to get their health restored, as promises and predictions have long since ceased to bring relief and now only aggravate their malady.

* * *

FREQUENT disagreements between the opinions of an editor of a country paper and one of his subscribers recently brought out the following: "Brother, don't stop your paper just because you don't agree with the editor. The last cabbage you sent us didn't agree with us either, but we didn't drop you from our subscription list on that account."

* * *

The Value of Their Contracts.

The Metropolitan Street Railway Company of New York is about to erect the largest power house in the world at the foot of East 96th street. It will take \$300,000 worth of machinery to equip it and the General Electric Company has been given the contract. The station will have a capacity of 70,000 horse-power.—*Floating item.*

Is this another sample of the boasted prosperity of the General Electric Company? Where is the profit in taking a contract to install electrical machinery at \$4.29 per horse-power?

* * *

A NOVEL use to which the telephone was put was related as follows in a recent number of the *New York Sun*:

A Chicago man had a fox terrier of which he was very proud, and the dog was completely devoted to him. He had to go to some place in Michigan on business which kept him away for several days. As soon as he had gone the dog began to suffer from a severe attack of loneliness. He wouldn't eat, and lay about mooping until the man's wife was afraid the terrier would die before his master's return. One night the man went into the station of the town where he was stopping and said that he wanted to talk to his dog. So connection was made with his house and the receiver was placed to the terrier's ear. Instantly he recognized his master's voice and began to frolic about and bark at a great rate. Two or three times after that the Chicago man repeated the performance, and he didn't mind the \$10 or \$12 that it cost him in the least.

* * *

The Last Application.

At San Francisco a company, composed of James McKendrick, Abraham Blumenthal, William Loewi, J. C. Meyerstein and L. F. Humphrey, has been incorporated, with a capital stock of \$1,000,000 and bearing the name of the "Electric Mortar Hardener Company." If this is not running electricity into the ground, it comes pretty near to it; still if the process gives us stiffer mortar than some of our builders have been known to use, the company deserves success.

* * *

THE Signal Office of the War Department at Washington is said to be deluged these days with suggestions and plans, with balloon, flying machine and other warlike devices, all of which appear to have some fatal defect. One genius is positive he has solved the problem of aerial navigation, and thinks his airship would be of inestimable value to the Government in case of war. His machine is in the form of a fish-shaped balloon, with electrically-operated propellers. Another would-be inventor suggests putting a powerful magnet in a torpedo which would lie along the shore. A steel ship passing in the neighborhood would, in the opinion of this genius, draw the torpedo up to its side, to be immediately followed by an explosion and the sinking of the vessel. There is certainly nothing like having a vivid imagination!

* * *

It is stated that the Electrolytic Marine Salts Company, which was originally founded on a heavenly vision and was organized to extract gold from sea water, and which we referred to in our issue of December 1, 1897, is now operating 100 machines, each of which extracts daily an average 7.87 pennyweights of gold and almost 15 pennyweights of silver. In other words, the plant is said to yield in

gold alone about \$125 a day on a \$50,000 investment. Ninety-one per cent. dividends such as this are certainly few and far between. Is this another stockjobbing scheme?

THE MEASUREMENT OF INSULATION RESISTANCE BY ALTERNATING CURRENTS.*

For some time past, a rule has been in force in Germany which requires that the insulation resistance of any electric installation which is to be connected to the supply mains shall be at least equal to

$$\frac{1,000,000}{n} \text{ ohms, when } n \text{ is the number of lamps fixed;}$$

and, further, that the test shall be made with a pressure equal to that at which the circuit will be worked. In order to avoid the necessity of carrying about a battery capable of giving a testing pressure equal to the working pressure of the circuit, various methods have been suggested of making the test by means of current taken from the supply mains; and these methods, particularly in the case of alternating current supply, have lately formed the subject of articles in both German and French technical journals.

One of the methods proposed consists of connecting one pole of the supply mains through an alternating current voltmeter to the circuit to be tested whilst the other pole of the supply mains is earthed, the insulation resistance being calculated, as in the case of direct currents, from the formula,

$$R = G \times \frac{V - V'}{V'}$$

where G is the resistance of the voltmeter, and V and V' respectively the readings of the voltmeter when connected between the two poles of the supply mains, and between one pole and the circuit under test. Objection is taken to this method, because the resistance of the ordinary electro-magnetic voltmeter for alternating currents is so low that the instrument cannot be used to measure the insulation resistance of a circuit where the number of lamps fixed is small. The objection is, of course, an important one, but we don't think that accurate results would be obtained by this method, even on circuits of which the insulation resistance came well within the range of the voltmeter, unless this latter was specially arranged so that the non-inductive resistance in series with the working coils formed a very large percentage of the total resistance of the instrument. Again, although one pole of the mains might be earthed if each installation was fed by a separate transformer, there would be very great objections to the earthing of one pole of a low tension distributing network.

To get over the first-named difficulty of want of sensitiveness, an instrument has been devised by the Allgemeine Electricitäts Gesellschaft in which the fixed coil is connected across the terminals of the supply mains, and is arranged to take a current of 1 ampere or more so as to produce a very strong field, whilst the circuit of the moving coil, which is of high resistance, is connected between one pole of the supply main and the circuit to be tested. This type of instrument should certainly give much better results than the ordinary voltmeter, but the objection to earthing one pole of the supply mains still remains, and renders this particular method of testing inadmissible in many cases. A slight modification of the method of testing would render the earthing of one pole unnecessary, but it would at the same time reduce the testing pressure from that between the supply mains to the pressure between one pole and earth; and this might be anything between the full working pressure and half that amount, according to the condition of the distributing network. Of course, the objection to earthing might be removed by using a small equal ratio transformer to supply the testing current, but this would be nearly as cumbersome to carry round as the testing battery.

* From the *Electrical Review*, London.

A bridge method has also been proposed and tried, the galvanometer being replaced by a telephone, and the battery by a connection to the supply mains, whilst the terminals to which the unknown resistance is usually connected are joined up, one to the circuit under test and the other to earth. This method has been tried with a working pressure 120 volts and a frequency of 50, but was not found sensitive enough to give satisfactory results, and although it is stated that accurate measurements could be made when the testing current was supplied by an induction coil instead of from the supply mains, the method does not appear to us to have any advantages likely to bring it into general use.

If any method is to be used in which the testing current is taken from the mains, we would suggest that the circuit to be tested should be connected to one pole of the supply mains through a non-inductive resistance, and that the potential differences between the terminals of this resistance and between the supply conductor and earth should be measured by an electrostatic voltmeter. The insulation resistance of the circuit would be given by

$$R = r \times \frac{V - V'}{V'}$$

when r is the value of the non-inductive resistance, and V and V' respectively the readings of the voltmeter when connected to earth and across the terminals of the resistance. The value of the resistance, r , must, of course, be such

that it is at least equal to $\frac{R}{x - 1}$ if R is the highest insulation resistance to be measured and x the ratio of the highest and lowest readings of the voltmeter.

Mean Horizontal Candle-Power.

The mean horizontal candle-power of an incandescent lamp is usually taken as the measure of the light emitted. This is perhaps the best measurement to take, but with certain of the new types of filaments will have to be replaced by the mean spherical candle-power. The mean horizontal candle-power can be obtained either by the laborious method of taking a large number of readings at different angles, or by spinning the lamp so as to obtain optically the mean candle-power. There have been doubts, though, on this spinning process as to whether it will give accurate results. Deformation of the filament due to centrifugal force would be the most likely cause of error, if any. Mr. C. P. Matthews contributes an article on this subject to the current number of the *Physical Review*. His experiments were carried out at the Purdue University, and show conclusively that no such error exists. Thus the whirling lamp gave a mean horizontal candle-power of 9.649, while the figures obtained by plotting the series of readings for different angles and integrating the curve was 9.655 c. p. This shows an error of .06 per cent. only, which is very well within the limits of photometric accuracy.

The Naval Appropriation Bill.

Among the items contained in the Naval Appropriation bill are the following of interest to the electric industry: An addition to the electric light system at the Brooklyn Navy Yard, \$15,000; steam generator for heating purposes and electric plant at the League Island Navy Yard, \$5,500; for improvement of the electric plant at the Washington Navy Yard, \$16,000; for enlargement of electric plant and concentration of steam at the Norfolk Navy Yard, \$20,000; extension of the electric light system at the Mare Island Navy Yard, \$15,000; for electric plant for Puget Sound Naval Station, \$9,800.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XV.—The Hargreaves-Bird Alkali Process.

In Chapter IV* of this series, a description of the cell patented by Messrs. Hargreaves & Bird was given, together with figures showing the results obtained in trial tests extending over 59 days at Farnworth. In Chapter VIII† reference was made to the industrial trial of this process about to be inaugurated by the St. Gobain Chemical Company in France. The writer is now enabled to give further details of the trial runs of this process at Farnworth, this information having been obtained by him during two personal visits of inspection of the plant, made in November, 1897, and January, 1898.

The request made for permission to visit the works at Farnworth was cordially granted by the company's managers, and every facility was afforded to enable the writer to acquaint himself with the details and working results of the process. He takes this opportunity of acknowledging the courtesy of Mr. James Hargreaves and Mr. C. C. Connor on the occasion of his two visits. The experimental work at Farnworth has now been carried on for over two years, and the form and size of cell, and the method of working, most suitable for the larger plants now contemplated are stated to have been finally settled. It is somewhat unusual to find any company in possession of valuable patents taking so much time and trouble to find out the best conditions of work before selling their patents to the general public. As a general rule the patents are sold first, and the best conditions of work are found out afterwards—at the public's expense. Too often there are no best conditions of work to be found, and the public is left in possession of worthless patents. The change inaugurated by the General Electrolytic Parent Company is refreshing to those who seek honesty in business and industrial affairs, and one can only hope that the example they have set will find more imitators on both sides of the Atlantic. The energy at Farnworth is supplied by an Otto gas engine of 14 nominal horsepower, driven by gas from a Dowson gas producer. This engine drives a dynamo, made by Holmes of Newcastle, by belting at 350 revolutions per minute. The dynamo is built to deliver 2,200 amperes at 5 volts. The whole of this current is used in the single large cell that has now been in operation for some months at Farnworth.

Internal dimensions of this cell are 60" x 120" x 14" wide. Mr. Hargreaves claims that it is the largest electrolytic cell for the production of alkali that has yet been built. It represents in fact one unit of the larger plant about to be built, and this will only differ from the plant at Farnworth in the number of such cells that are erected. The external appearance of the cell is illustrated in Fig. 1. The interior of the cell, after removal of one of the combined diaphragm cathodes which form its sides is shown in Fig. 2. The five vertical columns of rough blocks are the anodes. These are formed by roughly shaping blocks of gas carbon, each of which is pierced by a perfectly round 3" hole. These blocks are then fitted on to a central conducting shaft made of a lead-copper alloy, and the parts where bare metal is exposed are covered with a special cement. Six of these built-up anodes are used in this large cell, and they are stated to be superior in working results to any forms of carbon anode yet tried. These anodes are the invention of Mr. C. C. Connor of Belfast, one of the directors of the company, and the patents are now owned by the "General Electrolytic Parent Company," who likewise own the Hargreaves-Bird patents.

The solution of carbonate of soda found in the two outer or cathode chambers of the cell runs away

continuously into the small iron vessels placed below the cell.

Samples of this liquor were taken on both occasions by the writer, and these yielded on further examination the following mean results:

	Diaphragm Age.	Sp. Gr.	%Na ₂ CO ₃	%NaCl	Molecules NaCl per 100 mols. Na ₂ CO ₃
1st visit..	40 days.	1.125	10.94	.94	15.6
2d visit..	1 ½ days.	1.094	10.44	.10	1.7

The normal life of the diaphragms, which have a cell surface of 50 square feet and are from ½" to ¾"

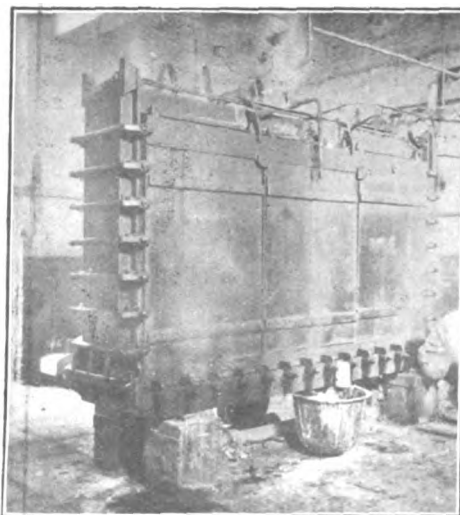


FIG. 1.—EXTERIOR OF HARGREAVES-BIRD CELL.

in thickness, is thirty days, and those in use on the occasion of the writer's first visit to Farnworth were being purposely worked for a longer period in order to see the results. The high percentage of undecomposed salt in the solution flowing from the cathode chambers of the cell on the first occasion, and the very low percentage of the same on the



FIG. 2.—INTERIOR OF HARGREAVES-BIRD CELL.

second occasion, show that the age of the diaphragm is intimately connected with its efficiency in preventing diffusion of the brine from the inner (anode) to the outer (cathode) chamber. The manufacture and renewal of the diaphragms will therefore form a considerable feature in the industrial working of the Hargreaves-Bird process.

The alkaline solution flowing from the cell contained no chlorine or hypochlorites. At Farnworth it is concentrated and then allowed to crystallize, and the decahydrate (Na₂CO₃ + 10H₂O) is obtained. It is considered that this form of soda will prove the most profitable, though both soda ash and caustic soda are alternative products. The chlorine liberated at the row of compound anodes in the inner chamber

of the cell is led away by the vertical pipe seen to the right hand of Fig. 2, by which the constant overflow of brine is also carried away.

The brine and chlorine gas are led to a separating well, from which the gas passes to a bleaching-powder chamber, or to a chlorate of soda tower, both of these chemicals being manufactured at Farnworth. The chlorine gas is quite free from hydrogen, and the bleach and chlorate made at Farnworth have been of excellent quality. It is stated that one of the difficulties of the processes in which mercury is used as cathode in order to form an amalgam is due to the presence of hydrogen in the chlorine gas from the anode chambers; this leads to considerable difficulties in the manufacture of high strength bleach. The chlorine gas from the Hargreaves-Bird cell is free from this impurity and this difficulty is avoided.

The brine in the separating well comes into contact with fresh salt, and after restoration to its original strength, it is pumped back into the cell, the circulation being kept up continuously. Owing to the heating effect of the current, and to the heat transmitted by the diaphragms from the steam condensing on their outer sides, the temperature of the brine in this inner anode chamber of the cell is maintained at 70° C. The following figures of the last two consecutive runs of the plant at Farnworth give the details from which the currents and energy efficiencies may be calculated. These have been worked out by the writer upon the same basis as those given in Chapter IV (l. c.) and are given in the last two columns of the table. The amperes, volts and pounds of salt decomposed are all mean figures:

Period of run.*	Amps.	Volts.	Salt per 24 hours.	Efficiencies %.	
				Current.	Energy.
Sept. 15—Oct. 11.	2081.5	4.2	217.3 lbs.	92.7	50.05
Oct. 12—Nov. 17.	2089.8	4.24	218.06 lbs.	90.4	48.99

* The cell is run continuously (day and night) after new diaphragms have been placed in position, until these are worked out. The normal life, as already stated, is thirty days.

The current density now being used in working this cell is rather higher than that originally used, the gain being an increased yield from the same plant. Under normal conditions of work the current density employed is 21 amperes per square foot.

This process will shortly be launched upon a large scale in England, negotiations for the purchase of land and brine pumping rights having been already commenced. The locality chosen is Cheshire. Those in charge of the arrangements have not yet decided whether steam engines or gas engines shall be used to generate the electric energy, the advantages of the latter being not only lower cost of the KHP. hour, but also the production of the carbonic acid required for the cathode chamber of the cell, without any extra costs for raw materials or apparatus by which to generate it.

This process has undergone such a long trial at Farnworth, that one must feel confident the difficulties incident to all new processes have been discovered and successfully overcome, and that reliable data upon which to base the estimates of cost per ton have been obtained. The determination of the directors of the General Electrolytic Parent Company to now offer their process to the general public, and to obtain the requisite capital for the construction of a large works, is proof of confidence in the value of their process. The writer hopes that freedom from unexpected difficulties, and financial success, in their future operations may be the reward of the lengthy experimental trials that have taken place at Farnworth.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

* ELECTRICITY, September 15, 1897.
† ELECTRICITY, November 10, 1897.

A SURVEY OF THE POSSIBILITIES OF ELECTRIC HEATING AND COOKING.*

BY W. P. ADAMS, A.K.C., A.I.E.E.

Many of you will doubtless be able to call to mind the old fable in which a visitant from another world was vastly puzzled by seeing a mortal blowing upon his fingers to warm them, and later upon his hot food to cool it. It is not by any means uncommon to find this species of inordinance occupying the minds of members of the public when electrical engineers claim that electricity will produce the coolest light and also cook one's food and heat one's house. As this feeling is not confined solely to members of the public, but is shared by some gentlemen of our own profession, you will perhaps be inclined to agree that it is pardonable in a layman.

My desire this evening is if possible to pave the way to a better understanding of the possibilities of electric heating so that engineers may be able to assume that confidence as to its merits which is necessary before any real progress can be attained, and which is at present lacking in many a professional mind. The feeling is general that the cost is, and will be to the end of the chapter, so great that its adoption can only be hoped for by those of more than ample means, but I hope to show that while it undoubtedly deserves to rank as a luxury it will be well within the means of those with average incomes when the cost of current is somewhat modified. The reason why electric heating, more especially in the direction of cooking, is able to compare favorably with other methods is, that the heat can be applied just where it is required, and there is remarkably little waste. I well remember in my student days being struck with a description of the Norwegian cooking pot in a copy of Deschanel's "Heat," and wondering if the principle could be applied to cooking by electricity. I saw that if the contents of the pot were raised to boiling point, little heat was required to maintain it at that temperature. In a general way this principle is used in the electric oven.

Notwithstanding this, heating appliances do absorb what appears to be a large amount of electricity, and many electricians, especially those more closely connected with electric lighting, are surprised at the large amount of current which is necessary for cooking purposes, and mentally compare what might be done with the same current if devoted to the production of electric light.

It will perhaps render clearer the remarks I am about to make if I give you some general idea of the current necessary for producing certain results.

As it is in the direction of electric cooking that I anticipate the largest development in the near future, I shall confine myself at first to a consideration of this subject.

In a kitchen suitable for supplying the needs of a family of from eight to ten persons the following apparatus would be necessary: Oven, absorbing 2,500 watts when heating up for about 15 minutes, and on the average about 1,200 watts afterwards. Breakfast cooker, wound for two circuits, each absorbing 600 watts. Two grillers, each wound for 500 watts. Two frypans, also wound for 500 watts, and several hot plates for warming ordinary saucepans, or in place of these several self-contained electric saucepans. These plates or saucepans would probably absorb 1,500 watts together. The household supplied from such a kitchen would probably have a maximum demand for not more than 2,500 watts for lighting purposes. The total watts which could be absorbed by the cooking apparatus is 7,200. It must, however, be borne in mind that these various appliances are used at different times, and never altogether.

We shall now consider the difficulties in the way of the adoption of electric cooking. First and foremost is the question of the cost of current. This is

all important. In addition to this the first outlay cannot be overlooked, owing to the rather high cost of the apparatus.

The largest field for the development of electric cooking is undoubtedly in private houses supplied from central stations, and if there is to be any large extension in this direction the central stations must be prepared to supply current at a more moderate price than is now charged for lighting. It is generally recognized that electric cooking will eventually prove to be the means of solving the much vexed question of securing a day load for central stations; and in view of this fact many of the central stations offer special terms for supplying electric currents for heating. A number of the central station engineers are, however, still doubtful as to the advantage of adopting electric heating, partly owing to the question of the load overlapping the lighting load. This question I shall touch on later, but I would venture to point out that, if the demand is spread over a sufficient number of hours, electric heating is worthy of consideration quite apart from electric lighting, and it would therefore pay to put down extra plant to meet the additional demand. In fact, I do not think the day is far removed when the demand for current for electric heating will vastly exceed that for lighting purposes; and I submit that the solution of the question lies mainly in the hands of the present suppliers of electricity. If they are prepared to adopt a liberal policy of supplying electricity for heating purposes, perhaps at little more than the actual bare cost, they will very soon find that the improved conditions under which they run their plant will begin to repay them handsomely.

The price to be charged is of the greatest importance, and I will therefore make a few comments upon the methods of charging now in vogue. Anyone who makes a careful study of *Lighting's* very valuable "table of costs," will observe that it is becoming usual to make the charge for heating and power about half that made for light. A usual figure is 3d. per unit, while some suppliers have brought the price down to an even lower figure. I may say at once that the ideal to be aimed at for heating and power purposes is a charge of 1d. per unit, and although it is only possible at present for one or two companies to charge such a figure and cover the bare cost of production, I think the figure is well within the range of practicability, and with a rapidly growing load on supply stations, I think it will soon become general. It is noticeable that the local authorities are moving more rapidly in this direction than supply companies. I would commend this to the attention of the supply companies. Their policy of making high charges is, to say the least of it, unprogressive. Only about four are charging so little as 3d., while 26 of the local authorities supply at 3d. or less, 13 of these charging 2d. and less.

The Wright system of charging for electricity appears to be securing considerable support amongst central station engineers, and the maximum demand system seems to have been receiving even greater favor. With both of these systems I can foresee a trouble in connection with the supply of electricity for heating purposes.

Under the Wright system it is conceivable that the demand meter may run up to a most unusual height, through the inconsiderate switching on of a number of the heating appliances together, the indicator therefore furnishing quite an abnormal record upon which the charges are to be based. Again, with the maximum demand system, if the charges are to be made upon the usual understanding that the whole apparatus is to be run for an hour at the maximum charge before any reduction is made, the charge cannot come down to anything like a reasonable figure. It is of course obvious that the whole of the appliances will not be in use together, and I think this point is worthy of close consideration.

In a certain kitchen it was found that the various cooking appliances were in use for from five to seven

hours a day, during which time the highest point reached was 1.5 kilowatts. The average consumption during the day was from 8 units. It will thus be seen that if generating plant to the capacity of 2 kilowatts was installed for supplying these cooking appliances it would have an earning capacity of about 1,400 units per kilowatt installed per annum.

I find that the number of units sold per annum per kilowatt of plant installed varies considerably among the different stations in country towns where the load is almost exclusively a lighting one and the supply is very small during the day time; about 400 or 500 units represent the work done during a year by one kilowatt of plant installed. In the larger towns, where there is probably a small day supply for power as well as one for lighting in dark offices and basements, the demand is larger. In Brighton, 840; Edinburgh, 640; Glasgow, 696; Manchester, 700. It will be seen that Brighton, which might almost be termed a country town, as there are no factories there to absorb power in the day, shows the best results of those named. This, I think, is traceable to the moderate nature of the charge for current.

As so little has been done in a general way in this direction, it is not possible to obtain exact data indicating in any definite manner what the load curves due to heating are likely to be, but I have been able to build up from figures at my disposal a very rough load curve for cooking appliances. It is obvious that the peaks of the load will be at the different meal times. The load will run up from 6 A. M. to 7 A. M. rapidly. After this it will be fairly level to 8:30. It will then drop rapidly until about 9 when the curve will begin to rise again for early dinner and lunch; from 10 until 1 it will be fairly level, reaching its maximum at a little after 12. After 1 it will fall rapidly until 3 or 4 when it will begin to rise a little for tea. It will continue to rise and will attain its maximum between 6 and 7. After this the decline will be fairly rapid, and there will probably be a little rise again between 8 and 9. I have obtained these rough general results from the study of single curves, making due allowance for the overlapping of the different curves in those cases where meals are taken earlier or later.

As a load for summer time, cooking should prove invaluable to supply stations, and the question of overlapping during this period does not arise. I think it is perhaps unnecessary to deduce evidence that electric cooking would be of great advantage to central stations during the summer time, but I may point out that the introduction of penny-in-the-slot gas meters in the South Metropolitan Gas Company's area has led to an enormously increased consumption of gas in summer, mainly for cooking purposes. The gas companies suffer (if we can say that such wealthy monopolies suffer at all) from light loads in the summer time, in the same manner as do electric light stations.

In winter, however, the conditions will be different. A certain amount of overlapping will occur owing to the prevailing fashion of late dinners, but I submit that the load for electric heating is likely to be of sufficient importance to warrant putting down additional plant to meet this.

Much, of course, depends upon the acuteness of the peak as to how this question is to be met. If it can be arranged, it will be desirable to utilize for heating during the day the plant installed for lighting purposes, but if the demand for heating grows to such an extent as to greatly surpass the lighting load, the question becomes of less importance. It is not, perhaps, within my province at this moment to suggest how this difficulty is to be met, but with some stations in this country the question does not arise at the present time, as ample plant has been installed to meet the lighting requirements and still leave a balance in hand to allow for the overlapping. This will be seen by looking through the columns in

* Read before the Northern Society of Electrical Engineers, Manchester, Eng., January 21, 1898.

Lightning's table of costs, giving the maximum load and the kilowatt capacity. A number of stations appear to be provided with twice the amount of plant required to meet the maximum demand. Of course some portion of this is reserve plant, but there still remains a good balance in hand to meet this contingency.

I am inclined to think that a secondary battery would prove of great value in meeting the peak difficulty, as there are several depressions on the day load curve which could be filled up if the generating plant were employed during these times of light load for charging the accumulators. How far it is possible to economically utilize accumulators for this purpose in alternating supply stations is an open question.

While considering the charges made by the various supply companies it is noticeable that several have adopted the enlightened policy of charging for power

getting a satisfactory day load the time does not seem very far distant when such a consummation will be reached.

The results obtained at Cardiff are interesting. It is one of those towns which adopted the policy of charging for heating and power purposes at a less price per unit than the actual works price. The returns for the year 1895 show a consumption of 400 units per kilowatt installed. The works cost was then 3.1d. per unit, and the total cost 3.69d. per unit, the charge for power being 3d. In the return for 1896, I find that 700 units were sold per kilowatt of plant installed, the works cost had come down to 2.86d., per unit, and the total cost to 3.06d. per unit. This satisfactory result may be due to local circumstances favoring rapid development, but the figures appear on the surface to be significant. I also desire to draw attention to the following supplies: Sheffield is charging 5d., with the works

electricity is used, but this is fixed so that it is of little value in the way of reducing the price.

It seems almost incredible that, in these enlightened days, the foremost city in the world should be one of the worst supplied in the matter of electricity.

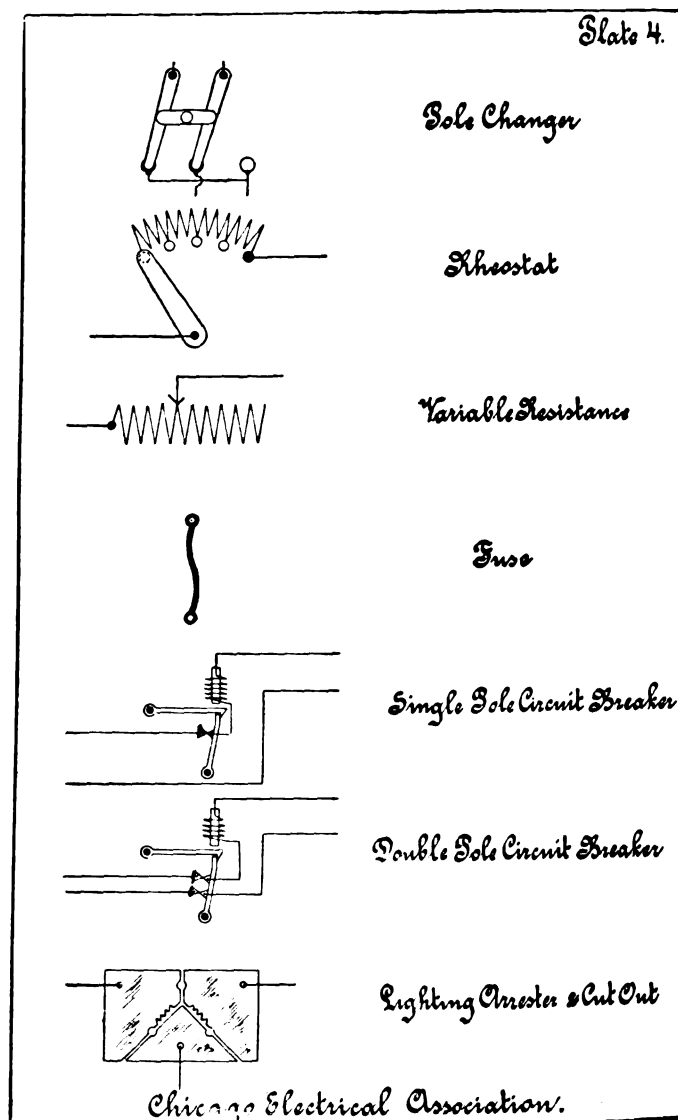
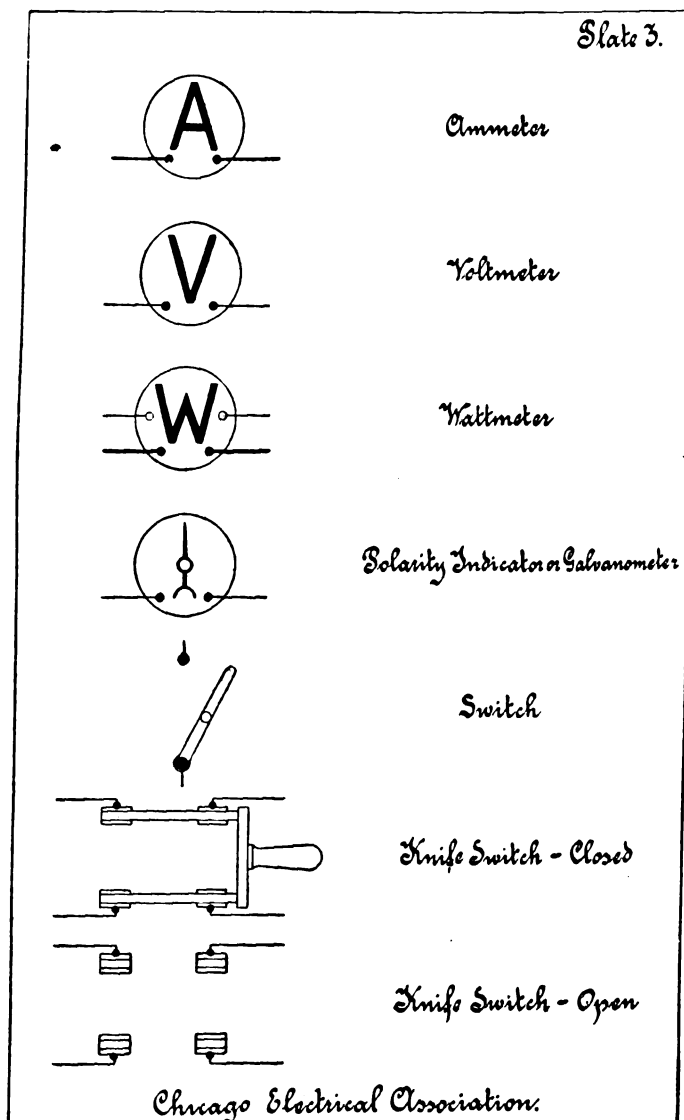
(To be continued.)

STANDARD SYSTEM OF ELECTRICAL DIAGRAMS.

(Continued from page 104.)

In last week's issue we published Plates 1 and 2 of the Standard System of Electrical Diagrams. These two first plates showed the proposed diagrams for dynamos, motors and batteries. We give to day Plates 3, 4, 5 and 6. In our next week's issue we will conclude the series by publishing Plates 7 and 8.

The diagrams on Plate 3 of electrical measuring instruments need no comment, owing to their ex-



and heating purposes a price which is actually less than the total works cost. Putting on one side for one moment the question of overlapping, it is obvious that this is a right policy to adopt as assuming that the plant need for lighting is employed for supplying heating appliances, the charge for rent, management, etc., will remain practically the same.

The following facts with regard to charges by different supply companies are worthy of note: In Edinburgh the charge for power is 2d., the works cost is .63d., and the total cost, 1.13d. per unit. In Glasgow the charge is made on the maximum demand system, 6d. the first hour and 2½d. after. The works cost is 1.32d., and the total cost 1.92d. per unit. In Liverpool the charge is 2d., the works cost 1.14d. and the total cost 1.77d. per unit. These charges are moderate, but I think in some cases would still bear reduction. It is to the large towns that we look at first for the introduction of the penny per unit charge, and if these towns can succeed in

cost at 1.48d., total cost 2.2d. per unit. The Westminster supply is charging 4d., the works cost being 1.24d., and the total cost 2.09d. per unit. The Chelsea Co. charges 4d., with a works cost of 1.48d., and a total cost of 3.08d.; and, last but not least in more senses than one, the City of London Electric Lighting Company is charging 8d., with a works cost of 2.46d. and a total cost of 3.5d. per unit. I have the misfortune to be situated in a district served by the City of London Company, which company holds a monopoly and takes advantage of this to maintain a charge which is worthy of the very early days of electric supply. Although their works cost compares anything but favorably with other large towns having in many cases a much smaller output, I think you will agree with me that the charge of 8d. is somewhat extravagant, and I may say that such a charge absolutely prohibits any demand for current for power and heating purposes. It is true that a rebate is made if more than a stated quantity of

treme simplicity and the unmistakable evidence which they bear to their identity.

In the matter of single and double circuit breakers, many forms of diagrams were considered, each of which would probably have their advantages in certain places. This brings out well the fact that these diagrams must be taken merely as a guide, and not as a rigid code which must be absolutely followed. For instance, if it were essential that the circuit breaker should have an operating coil in each of the line wires, then it must be left to the designer or illustrator to make his own diagram for illustrating the particular case in hand.

On the simple telephone diagrams but little comment is needed. It would be well if all would adopt the form of transmitter shown, from the fact that its construction is so extremely simple.

The listening and ringing key for telephone switchboards is a simple representation of one of these pieces of apparatus in common use. The re-

marks made concerning the out-outs will apply with equal force to these.

The diagrams for polarized bells are shown. The one on the right hand side is preferable where its meaning can not be mistaken. The almost universal adoption of this form of diagram has led the committee to show it here, although unless one is familiar with polarized bells in telephone work it must be said that it is not at all suggestive. In cases where it is thought best to be extremely explicit, or where the immediate context of the diagram does not suggest the use of a polarized bell, the diagram on the left is to be preferred.

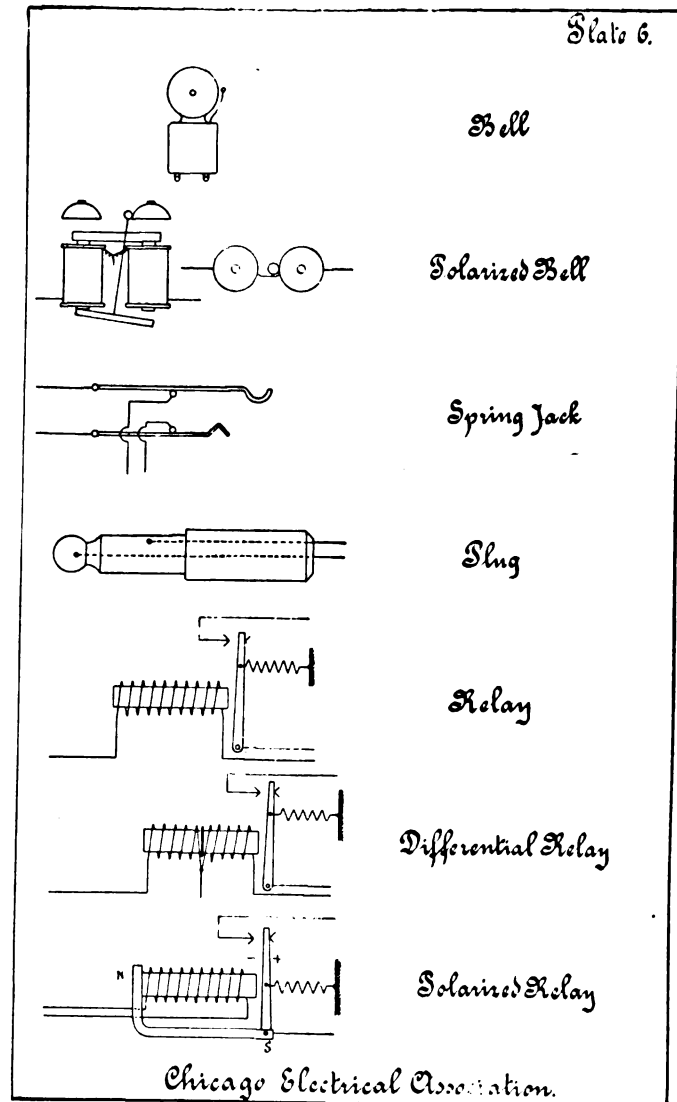
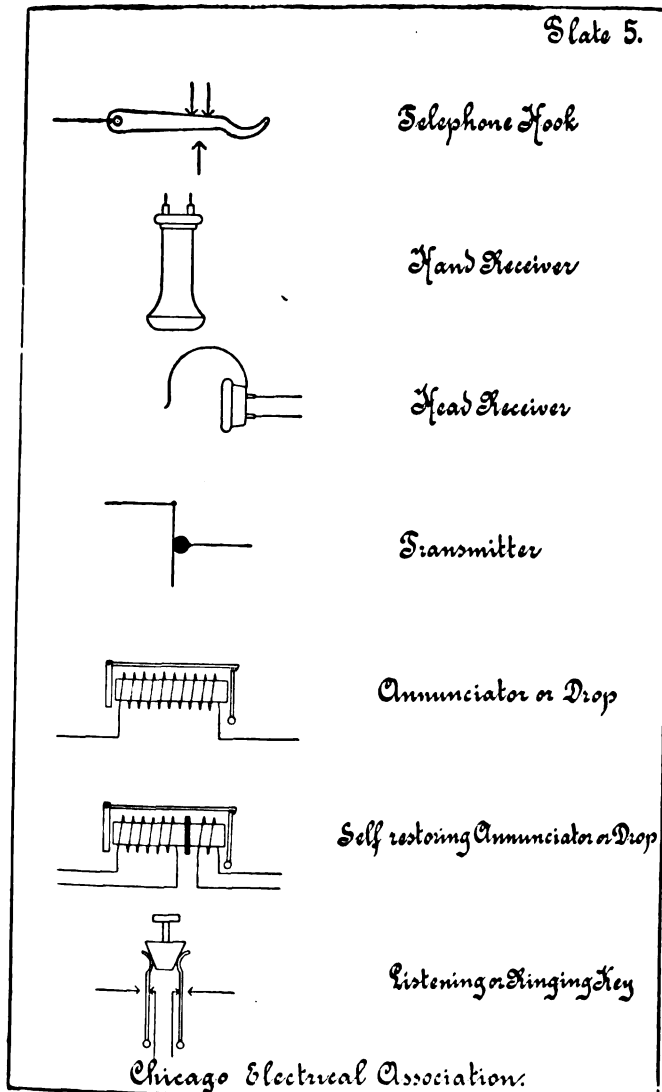
In the diagram for a polarized relay, by changing the plus and minus signs from one side of the armature to the other, it may be indicated that the relay will close on a minus current and open on a plus

AN ELECTROLYTIC PROCESS FOR THE MANUFACTURE OF PARABOLIC REFLECTORS.*

BY SHERARD COWPER COLES.

Glass mirrors at the present time are almost exclusively used for projectors for searchlights and similar purposes, on account of the difficulty that has been experienced in producing a true metallic reflector that will not readily tarnish when exposed to the heat of an arc light. One advantage of a metallic reflector is that the rays from the carbon points are collected into a parallel beam by means of refraction only, and is not catadioptric, as most glass mirrors are. Spun reflectors are never true, as it is found in practice impossible to spin them quite true to the moulds. Experiments have been made with

placed in a suitable ring and frame (which I will describe later on), and immersed in an electrolyte of copper sulphate, the mould being rotated in a horizontal position, the number of revolutions being about 15 per minute. The copper adheres firmly to the silver, and together they form the reflector, which is subsequently separated from the glass mould by placing the whole in cold or lukewarm water, and then gradually raising the temperature of the water to 120° Fahr., when the metal reflector will leave the glass mould, due to the unequal expansion of the two. The concave surface of the reflector obtained is an exact reproduction of the surface of the mould, and has the same brilliant polish, and requires no further treatment to answer all the purposes of a reflector, with the exception that it must be coated with a film of some suitable



current, or vice versa. This is a feature which will be found at times very convenient.

Protecting Power Lines from Lightning.

The protection of power transmissions from lightning was made the subject of a paper read to the students of the London Institution of Civil Engineers on February 11 by Mr. J. T. Morris. The author said that the importance of the efficient protection of electric power transmission circuits from lightning was shown by the fact that in some of the earlier installations it was found more economical to shut down the generating plant than to run the risk of burnt-out armatures or similar mishaps during severe thunderstorms. The danger existed not so much in the conduction of the discharge to earth as in the arc started by lightning being maintained by the current. The author demonstrated the relation between the sparking distances and voltage, by means of a curve, and he showed that the discharges from which the line must be protected were: (1) those due to lightning actually striking the line; (2) the rush and surges of electricity induced in the line; (3) those due to slow accumulation of the charge. The first were extremely rare and the third only occasional, but the second were the most frequent.

a view to substituting cast metal for glass, but the cost of grinding and polishing, and the unsatisfactory surface that is obtained, have resulted in the attempts being abandoned. Stamped reflectors have also been tried, but with no more satisfactory results. The present process I propose to describe to you is an electrolytic one, one of the chief features being that the surface produced requires no after polishing or trueing up. When once a true mould has been produced, any number of reflectors can be taken from it at a nominal cost. A glass mould is prepared, the convex side of which is accurately shaped and polished to form a true parabolic or other reflecting surface. As the mould only requires shaping and polishing on the convex side, it is comparatively cheap as compared to a glass reflector, which has to be ground on both sides. On the prepared surface is deposited a coating of metallic silver, which is thrown down chemically on the glass and then polished, so as to ensure the copper backing being adherent to the silver. The mould thus prepared is

* Paper read before the Institution of Electrical Engineers, London, February 9, 1898.

metal to prevent tarnishing. Palladium is found to answer this purpose best, as a bright coating can be deposited rapidly to any desired thickness; the palladium resists tarnishing and the heat of the arc to a wonderful degree.

Palladium is a silver-white hard metal, and is sufficiently ductile to be rolled into thin sheets. Its specific gravity is about 12, being half that of platinum. The present price of palladium is about double that of platinum, but, its weight being only one-half, the same area can be covered at the same cost. It melts at an extremely high temperature—about the same as wrought iron. When only slightly heated in hydrogen gas, it has an extraordinary power of absorbing mechanically large volumes of this gas. Graham investigated this very curious phenomenon, and found that a piece of palladium foil when heated below 212° Fahr. takes 240 times its volume of hydrogen, but that it had not the power of absorbing oxygen or nitrogen. At a moderately high temperature palladium assumes a blue color, and the formation of a thin film of oxide, which it loses at a higher temperature, due to the

decomposition of the oxide. Palladium is not readily attacked by sulphuric or hydrochloric acid.

In carrying out the manufacture of reflectors by this process, it is essential that the glass mould be perfectly clean and free from grease before the silver coating is applied. It has been found, however, that, if the cleaning is solely effected by chemical means, there is a great liability of the silver adhering too firmly to the glass, whereby the mould is in danger of being broken during the removal of the reflector. This difficulty has been overcome by cleaning the glass mould with a suitable paste or powder such as peroxide of iron, then removing such paste or powder by washing the glass with a 50 per cent. solution of ammonia. It is necessary that this cleaning operation be repeated prior to the production of each reflector. After the convex side of the mould has been properly cleansed as described, a thin coating of metallic silver is applied as follows: Ammonia is added to a solution of nitrate of silver until the precipitate that is first formed is redissolved, then re-precipitating by caustic soda, again dissolving in ammonia, then adding glucose to the solution. Excellent results have been obtained with a silvering solution of the following components, equal parts of each being used: Silver nitrate, 0.5 per cent.; caustic potash, 0.5 per cent.; glucose, 0.25 per cent. The surface of the mould to be coated is immediately dipped into the solution, when it becomes coated with a film of silver. The silver coating is thoroughly washed, and then allowed to dry, and the silver which has been deposited is burnished bright with a piece of cotton-wool and peroxide of iron, preferably precipitated by ammonia from a dilute solution of ferrous sulphate. The cost of the silvering is found to vary from 2d. to 4d. per inch diameter. I have here a film of the silver and copper stripped from a glass mould, which is quite transparent to transmitted light having a green tinge, but is capable of reflecting light.

(To be continued.)

A May Meeting of Street-Car Men in Chicago.

At a meeting of the Executive Committee of the Street Railway Men's Association of Illinois, held in Chicago on the 19th ult., at which a number of representatives of supply houses were present, the question of holding an Exposition in Chicago in May next was thoroughly discussed and the general opinion was that the prospects were favorable for a successful exposition of street railway supplies at that time.

The meeting was called to order by W. J. Cook of the McGuire Manufacturing Company and at the close of the discussion he was instructed to appoint four others to act with himself to make immediate arrangements for the Exposition. The members of the Executive Committee of the Association present were President W. H. Patterson of Bloomington, Secretary C. H. Minary of Springfield, C. W. Barker of Peoria, W. L. Ferguson of Decatur, and W. F. Brennan of Chicago.

The firms represented were: Page Iron Works, Leschen, McComb & Wight, J. A. Roebing's Sons Co., Washburn-Moen Manufacturing Company, New York Insulated Wire Company, Abendroth & Root Manufacturing Company, Central Electric Company, Electrical Appliance Company, Griffin Wheel Company, McGuire Manufacturing Company, Adams & Westlake Company, McGill & Pomeroy, Simonds Manufacturing Company, E. T. Burrows Manufacturing Company, General Electric Company, Westinghouse Electric & Manufacturing Company, Peckham Wheel and Truck Company, Ajax Forge Company, Standard Railway Supply Company, Washington Carbon Company, Chicago Varnish Company, Wells & French Company, Western Electric Company, H. W. Johns Manufacturing Company, J. J. Ryan & Co., the Sargent Company, Heath & Milligan Manufacturing Company and W. D. Alling & Co.

LONDON NOTES.

[From our London Correspondent.]

Dr. Lodge on Coherers.

Dr. Oliver Lodge has been communicating a paper to the Physical Society on "Electric Signaling Without Connecting Wires," and he of course had a good deal to say about coherers. The coherer principle, he said, can be either applied to a purely magnetic or to the Hertzian system. It was first used by him in devising lightning guards, and afterwards by him in his magnetic system of telegraphy by inductive circuits, each in series with a Leyden jar, a pair of knobs in near contact or other overflow gap being provided in the receiving apparatus. This was the first meaning of a coherer in the electrical sense as used by himself. It referred to a single contact between two metal knobs. The term has since been extended by others to the filings-tube of M. Branly, and some confusion has arisen, for M. Branly does not consider simple coherence and break explains fully the behavior of his instrument. Prof. Lodge is disposed to agree, for he finds that the resistance of almost any form of coherer varies in rough proportion to the received impulses, and there are other peculiarities; he is therefore inclined to think that the action cannot after all be entirely explained as due to mere "welding," but that there is something more to be learned about it. The sensitiveness of a coherer depends upon the number of loose contacts; it is a maximum for a single contact, namely, for a needle point lightly touching a steel spring. With this sensitive coherer, hardly any "tapping back" is required for decoherence, but it wants delicate treatment when properly adjusted, and the greatest current through it should not approach a milliamperé. On the other hand a Branly tube rather improves under rough treatment; in such a tube Dr. Lodge prefers to use iron filings in the best possible vacuum; brass, too, is very good, but rather less easy to manage. Aluminum is thoroughly bad, and gold, for the opposite reason will not work, its surface is too clean. Points, or small surfaces for making contact with the filings, are better than the large surfaces. The usual method of connecting the coherer across the gap of an ordinary Hertz receiver, in parallel with the telegraph instrument and battery, has the unavoidable objection that they shunt away part of the received oscillations. With the syntonio receiver of Prof. Lodge, which contains no gap, but a closed wire coil instead, the difficulty no longer exists; for the coherer can now be in series with the detecting instrument, and in so far as these obstruct the oscillations, they may be shunted out in various ways. The main feature of Lodge's new syntonized vibrators is this self-inductance coil, whose function it is to prolong the duration of the oscillations, and thereby to render syntonio possible. Prof. Lodge has designed a revolving commutator by means of which the coherer can be rapidly changed over from the resonating circuit to the instrument circuit, and finally to the tapping back apparatus. A coherer is more sensitive when thus isolated and exposed to the full influence of the received oscillations; the subsequent detection of the effect by altered connections is very convenient for laboratory measurements.

The Next Meeting of the N. E. L. Association.

Mr. Geo. F. Porter, Secretary of the National Electric Light Association, advises us that the next meeting of the Association will be held in Chicago, June 7, 8 and 9 next, with headquarters at the Auditorium Hotel. The rates for accommodation at the hotel will be from \$3.50 to \$5 per day on the American plan, or \$2 to \$4 on the European plan. The hotel managers give the Association the use of their banquet hall for the meetings.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

STREET RAILWAYS IN MASSACHUSETTS.

The Bay State has a very enviable record in the matter of railroad legislation. Massachusetts not only took the lead among American commonwealths in establishing a State Railroad Commission, but has consistently pursued a policy in regard to what shall and what should not be exacted of that class of corporations which might well be copied with advantage to public interests and to capital by other States. At the same time, the Massachusetts Railroad Commission has, through the quality of the men who have composed it and the character of its work and reports, thrown more light upon the railroad problems of the age than any other body in the country. The same may be said of the special work which Massachusetts has accomplished in connection with transportation matters in general, and this applies with particular force to the work of the special committee appointed by the Legislature last year to report upon the relations between municipalities and street railway companies. This commission was composed of such experts as Hon. Charles Francis Adams, Hon. W. W. Crapo and Mr. E. B. Haynes. After an investigation which extended to all features of the problem, not only as it existed in the State and the country at large, but in Europe, this committee's report has just been issued, and it is not going too far to say that it constitutes the most valuable and exhaustive examination of the subject that has ever appeared.

Within a comparatively short period the street railway has thrust itself forward in a new form and presents exceedingly important and interesting developments. The introduction of electrical power and the discovery that the providing of increased facilities for communication, not only in towns and cities, but in purely suburban and rural districts, tended to develop an enormous traffic has virtually created within a short time a new industry and new outlet for vast amounts of capital.

In a great many States and municipalities the question of franchises and the respective rights and duties of the companies and of the State or city have been treated in a haphazard way. The legislation of Massachusetts dealing with this subject was perhaps somewhat better than that of many other States, but even it has not escaped from the mistakes and complications which arise after entirely new conditions are dealt with by the light of antique ideas. In some respects the report of the commission is not applicable to the circumstances which exist in this connection in other States, but there are some in which its conclusions will receive great attention, and it, moreover, is calculated to give a direction to further legislation upon the entire subject of street railroads.

One of the most important of these relates to the limitation of dividends upon the stocks of street railway companies. The committee's recommendation is that if dividends in excess of 8 per cent. are paid upon the stock of such companies, a sum equal to the excess should be paid to the State to be distributed among the towns in which the companies operate their tracks. This touches a very critical point in the entire question. The municipalities, in Massachusetts at least, seem to consider 6 per cent. a proper limitation, while capital is naturally clamorous for no limitation at all. Looked at from an unprejudiced standpoint it would certainly appear that some limitation would be salutary in effect, if for no other reason than to curb the propensity to stock watering, so common in connection with corporations of this kind, and for examples of which it is not necessary to go very far afield. Another recommendation of the committee for a tax upon gross earnings of street railways payable to the towns for paving, clearing snow, etc., bears upon a subject which has at most been imperfectly met in various communities and which has occasioned a great deal of trouble in many of them. There is no question that uniformity in this respect would be attended by satisfactory results and would end the divided re-

responsibility between the corporations and municipalities, the unfavorable effects of which can be seen in many places.

The final conclusions of the committee relating to the ownership of tracks and their operation, either directly or through leases to companies, opens up a wide opportunity for discussion. The evil of political control is not disregarded, yet the committee, after considering all the principles involved, is forced to condemn a more or less ill-regulated private ownership and is forced to conclude that experience, both here and abroad, points to the advantage of a middle course, involving municipal ownership of the permanent way of such roads with operation by private companies. The report contains many important and interesting features, even those propositions which relate to questions of taxation peculiar to Massachusetts being well worthy of detailed examination. It is a document which is entitled to a wide circulation, and which, however its details may be inapplicable to street railway conditions in other States, may be deemed the best elucidation that has yet appeared of this subject.—*Bradstreet's*, Feb. 26.

American Institute of Electrical Engineers.

The 123d Meeting of the Institute was held at 12 West 31st street, New York, on Wednesday evening last, and was called to order by President Crooker at 8:30. About seventy-five members and guests were present. A paper on "The Single Phase Induction Motor" was read by Mr. Steinmetz and was discussed by Prof. W. S. Franklin, Dr. A. E. Kennelly, Messrs. E. E. Ries, Townsend Wolcott and others.

At the meeting of the executive committee in the afternoon the following associate members were elected:

Frank Broili, electrical engineer, California Electrical Works, San Francisco, Cal.

Samuel Byington Lobby, superintendent N. Y. & S. I. Electric Company, West New Brighton, N. Y.

Otto T. Louis, manager of New York branch Queen & Co., Inc., New York City.

James A. Mortland, Prof. of Physics, Faculty State Normal School, Cedar Falls, Iowa.

Chas. H. Schum, electrical engineer, Ideal Electric Corporation, New York City.

C. E. Sedgwick, agent at San Francisco office, General Electric Company, Berkeley, Cal.

Joint International Meeting at Laredo, Texas.

Mr. W. E. Holmes, secretary of the Texas Gas & Electric Light Association, has sent us the following particulars in regard to the transportation arrangements, etc., for the approaching joint meeting at Laredo of the Texas Gas & Electric Light Association, the Texas Street Railway Association and Mexican gas, electric and street railway men:

Mr. Carl F. Drake, chairman Transportation Committee, reports having secured the following rates for the association's meetings at Laredo:

For the International meeting of the Gas, Electric Light and Street Railway Associations at Laredo, March 9th to 12th, the I. & G. N. Railway and connecting lines in Texas, New Mexico, Oklahoma, Arkansas and Louisiana will make rates based on the 167-mile distance plan as follows:

Less than 100 miles, \$3 for round trip.

100 to 167 miles, \$5 round trip.

Beyond 167 miles, 10c per mile each way added to the rate of \$5 for that distance.

(If you are 167 miles from Laredo it will cost you \$5 for round trip. If 200 miles, \$5.66 for round trip).

This is the lowest basis used for any organized meeting. Visitors, as well as members of the Associations, can take advantage of this rate, and it is expected that the attendance will be large.

Tickets will be good for eight or ten days. Return limit may be extended at Laredo for those who wish to visit the interior of Mexico. Ask local ticket agent for selling dates, return limit and connections for Laredo.

All are urged to be prompt in attendance at opening session at 10 A. M., Wednesday, March 9.

Members who expect to take their wives to the Laredo meeting should advise Mr. C. F. Yaeger, Laredo, Texas, at an early date, in order that pleasant hotel accommodations may be reserved for them. It is expected that hotel accommodations will be ample, but those applying early will have most desirable rooms reserved.

LEGAL NOTES.

The jury at La Crosse in the case of the White-house department store against the local Edison Electric Company failed to agree on a verdict after being out twenty hours. The case was a suit for \$54,000 damages by fire claimed to have been started by improper insulation.

The United States Court has appointed D. W. Flickwir receiver for the Roanoke Street Railway and the Roanoke Electric Light & Power Company of Roanoke, Va. Propositions had been made to consolidate the companies, and it is understood that the appointment of a receiver was made necessary in order to wind up the affairs of the concern before the consolidation scheme could be effected. Bills have passed both branches of the Virginia Legislature providing for the consolidation of the two companies.

In the case of Miss Regina Christy against the Northern Electric Light & Power Company, at Philadelphia, a verdict for \$1,500 was agreed upon. Miss Christy is only 19 years of age, and the tip of the umbrella which she carried came in contact with one of the defendant's light wires which was hung too low. She was so badly shocked that she has lost the entire use of her right hand.

The sheriff has taken charge of the office at 11 Broadway, New York, of the Puritan Electric Company on executions aggregating \$3,663, in favor of the Manhattan General Construction Company, on notes. The Puritan Electric Company was incorporated in October, 1896, with a capital stock of \$100,000, and manufactured arc lamps. Stuart W. Wise was president, and the concern was regarded by the trade as an adjunct of the Manhattan General Construction Company.

The United States Court of Appeals for the First District, Boston, on the 18th ult., handed down a decision sustaining all claims of the electric heating patent taken out by James F. McElroy, of the Consolidated Car Heating Company. This is not the same decision given last summer, but affirms the one rendered by Judge Putnam in that circuit on August 25 last. The decisions make the American Electric Heating Corporation of Boston, Mass., who furnished these heaters, infringers, together with the West End Street Railroad of Boston, against whom the suit was brought. The court grants an injunction against the further manufacture of these heaters by the Boston company, and also orders an accounting. This is the third suit terminated in favor of the Consolidated Company in its litigation with the American Electric Heating Corporation, and it is considered a final decision from which there is no appeal.

In the matter of the assignment of George T. Breakenridge, who dealt in electrical supplies on Broadway, Albany, the statement filed with the county clerk shows that the debts and liabilities amount to \$8,555.86 and the assets nominally amount to \$3,975.20.

The Fisher Electrical Manufacturing Company of Detroit has given George W. Bates, trustee, a \$6,037.08 chattel mortgage for the Detroit Savings Bank, and C. H. Meday, president of the company, a \$21,266.93 second mortgage to secure him for loans and indorsements. The company was started eight years ago by Frank E. Fisher, but has succumbed to the hard times and closed down two weeks ago. H. H. Meday is vice-president, W. E. Reilly secretary, and Frank E. Fisher treasurer. The stock is principally owned by Mr. Fisher and the Medays. Mr. Fisher says it has been almost impossible to secure contracts at profitable figures. The company failed under the name of the Fisher Electric Company in 1893 and was reorganized.

An order was filed in the county clerk's office, New York, on the 19th ult., made by Judge Olcott of the City Court, vacating the appointment of W. H. Shepard as receiver in supplementary proceedings for Frank W. Hawley, vice president of the Cataract General Electric Company, and directing Mr. Shepard to transfer to John M. Shedd, the receiver appointed by Justice Bischoff of the Supreme Court, all money and property which may have come into his hands belonging to Mr. Hawley. Mr. Shedd is now the sole receiver. Mr. Hawley, it will be remembered, was an enthusiastic advocate of the application of electricity to canal boat propulsion, and was the leading spirit in the tests that were made at Tonawanda in 1895.

THE NEWS.

What Is Going On in the Electrical World.

STREET RAILROADS.

Boston, Mass.—The street railway committee of the Legislature have under consideration the petitions of several electric railway companies for permission to do an express and freight business. There is a feeling in the committee that the progress of the times demand that larger powers be given to street railways in regard to the carrying of packages.

Buffalo, N. Y.—Work on the roadbed for the new Buffalo, Hamburg & Aurora Electric Street Railway is being done rapidly. The company has decided to place in its power house machinery which will give 1,400 instead of 500 horse power, the latter amount being originally planned.

Charleston, S. C.—The Charleston & Seashore Railroad Company has been chartered by the Legislature. The capital stock is \$400,000. The line will connect Charleston with Mt. Pleasant, Sullivan's Island and Long Island, to be called hereafter the Isle of Palms. The road will be operated by electric power and will be constructed in the most substantial and improved style, and be supplied with the most modern equipment.

Denver, Col.—An ordinance has been introduced in the city council authorizing the Denver City Cable Company to change its system from cable to the electric trolley.—An ordinance has been published in the local papers granting a twenty-year franchise to the Denver City Railroad Company for an electric car line in specified streets in Denver. The company is permitted to use any electric system, and to change from one system to another at any time during the existence of the rights granted that shall to it seem to the best interests of the public.

East St. Louis, Ill.—A number of East St. Louis and St. Clair county capitalists have organized a company for the purpose of building an electric line from East St. Louis to Collinsville, and possibly to Edwardsville, in Madison county. The incorporators are Albert Drummond, W. Drummond, Henry Drummond, W. L. Johnson, W. E. Hadley, T. E. Raine, William Ortger and John Schmidt. A large section of the right of way has already been secured.

Eldora, Ia.—The Patton street car motor is attracting much attention in this part of Iowa on account of its successful operation. A new street car line between Eldora and Waterloo, thence south to Nevada and Des Moines, is to be equipped with it. The new line will be utilized for freight as well as passengers.

Hamilton, O.—At the annual meeting of the stockholders of the Cincinnati & Miami Valley Traction Company, held here on the 17th ult., Judge Dennis Dwyer of Dayton, Britt Brown of Dayton, Isaac Silverman of Philadelphia, Max May of Cincinnati and Joseph Sutro of New York were elected directors for the coming year. The board organized by the choice of Judge Dwyer, president; W. P. Schwab, secretary, and Isaac Silverman, treasurer. The most important transaction of the session was the leasing of the Dayton & Miami Valley Traction line, making complete connections by this company between Hamilton and Dayton.

Menominee, Mich.—The car barns of the Menominee Electric Light, Street Railway & Power Company were burned last week. Five motor cars and five trailers were destroyed. Total loss, \$35,000.

Port Huron, Mich.—The St. Clair Tunnel Company is contemplating converting the motive power for the tunnel from steam to electricity. Ever since the awful casualty of November 28 the officers of the tunnel company have given the subject of electrical propulsion considerable attention, and they have now about decided to equip the tunnel with electrical power at as early a date as practicable.

Reading, Pa.—The directors of the Mount Penn Gravity Railroad Company have decided to equip their system electrically for the purpose of reducing expenses. It has been necessary to maintain several engines for the running of trains to the summit of Mount Penn, the return trip being made by gravity. Under the new system the engines will be dispensed with, although the descent from the summit will be by gravity as heretofore. The power will be furnished by the Reading Traction Company.

Rensselaer, N. Y.—The stockholders of the Greenbush & Nassau Electric Railway at a meeting held here on the 22d ult. adopted resolutions the purport of which was the pushing of work to complete the road. The following board of directors was elected: William O. Barnes, Fred Carr, Thomas D. James, Jared L. R. Davis, George Whitbeck, Gardner Morcy, Sylvanus C. Curran, Lewis Miller, John Garrison, Joel Morcy, Thomas W. Cantwell, W. Cochen, William Nichols, Warren Fowler, Edwin S. Comstock. The directors elected the following officers: President, W. D. Barnes; treasurer, Thomas W. Cantwell; secretary, Dr. S. C. Curran; superintendent, Fred Carr.

Richmond, Va.—A proposition that is receiving attention here is to run an electric road from Richmond to New Ferry. Such a road would, it is thought, do a large passenger business, as the route lies through the battlefields of Cold Harbor, Beulah Church and Gaines' Mills and runs directly by Cold Harbor National Cemetery. The road would also run through the center of the great trucking interests of Hanover, and reach at New Castle Ferry, on the

Pamunkey River, some of the richest grain and grass lands in Eastern Virginia. Grain, wood, lumber, feed and all kinds of freight would be lightened up and down the river to the road, to be taken to Richmond, and thence to other markets.—The franchise granted the Home Electric Company has been nullified by the failure of the company to deposit the \$5,000 guarantee. The Southern Electric Company, to whom a similar franchise was granted by the council at the same time as that of the Home, met this obligation in due time.

San Francisco, Cal.—The Market Street Railway is to be changed into an electric line.—A dispatch from Stockton to the "Chronicle" states that power from the Blue Lakes electric plant will be conveyed to San Francisco, a distance of 140 miles. A company with unlimited capital has been formed and will commence operations at once. Surveys have been made in San Joaquin and Calaveras counties, and it is stated by the attorney of the company that T. S. Bullock, who is at the head of the corporation, would begin work in a few days after the franchises along the county roads were granted, as the capital was in the bank to carry out the project. The line will pass through Bellota, Linden, skirt Stockton, cross the reclamation districts, touch Antioch and Martinez, and reach San Francisco by cable under the bay. The company will furnish power and light to all the towns through which it passes. The big pumps on the reclamation districts will be run by electricity, and light will be furnished San Francisco.

LIGHTING PLANTS.

Albany, N. Y.—A bill has been introduced in both houses of the General Assembly authorizing municipal officers of cities whose population does not exceed 50,000 to contract for the lighting of streets for a period not to exceed five years.

Athens, Tenn.—Long Bros. of the Athens Roller Mills has made a proposition to the mayor and council to furnish electric lights for the city, and the probability is that it will be accepted.

Baltimore, Md.—The Northern Electric Company, successor of the United States Electric Lighting Company in this city, is making extensive additions to the old plant which are being rapidly pushed. New and more powerful generating machinery will be introduced and the accommodations will be considerably increased by additions to the present buildings and the erection of a new boiler house.

Elgin, Texas.—Present indications are that Elgin will have an electric light plant in the near future, as parties are figuring on cost and maintenance of the same.

Fort Smith, Ark.—The board of public affairs of this city will receive bids up to and including March 5 for the lighting of the city with at least 70 arc lights of 2,000 cp. for a period of ten years from July 15, 1898. Bids will be received for electric lighting alone or for electric lighting in conjunction with building and equipping six miles of electric street railway within one year from July 15, 1898, or for both.

Gladbrook, Ia.—There is a growing agitation here in favor of putting in electric lights.

Hartford City, Ind.—The Panhandle Railroad Company is experimenting here with electricity in its semaphore signal lights, and if successful it will in all probability supplant the oil which has been in use since railroading was first known. Railroaders here say the electric signal semaphores can be seen at a far greater distance than those using oil. The success of the experiment is being watched with interest in railroad circles.

Hartwell, O.—Proposals for lighting this village by electricity will be received by the village clerk, T. H. Murpe, until March 17. Bids should be for not less than forty arc lights of two thousand candle power each and twenty incandescent lamps of thirty-two candle power each, and should specify the price per lamp at which light will be furnished, this price to include any additional lamps that may be required during the term of contract, which will be for ten years.

Lyons, Mich.—The common council is investigating the cost of an electric lighting plant with the idea of putting in one to be operated under municipal control.

Markham, Ont.—The waterworks and electric light plants were almost completely destroyed by fire on the 16th ult. The electric plant was owned by W. J. Fletcher of Alliston, and was not insured.

Neola, Ia.—At the special election held here to vote on an issue of bonds to put in electric lights, the affirmative vote was 169 to 32 against. The bonds will be issued at once and a plant erected.

Newton, Kan.—The "Republican" says: "The Rock Island Railroad Company is preparing to spring an innovation by the adoption of electric lights for its engines. Before long all the locomotives of the through trains will be equipped with electric headlights and the old-fashioned lamps will be discarded."

Richmond, Mich.—Another vote will probably be taken this spring on the question of bonding the village for electric lights.

Saugatuck, Mich.—The city council has granted a franchise to the Saugatuck, Douglas & Lake Shore Electric Railway Company. The road will connect with the electric road being built from Holland to Macatawa Park and is to be completed this season.

St. Louis.—The plant of the Ferguson Olive Branch

Electric Light & Power Company will be sold at auction March 10.

Thomaston, Ga.—A committee of three aldermen has been appointed by the mayor to confer with an electric company toward erecting a plant to supply electric lights.

LONG TRANSMISSION.

Hagerstown, Md.—Powell Evans, who sold his electric light plant in this city to officers of the Hagerstown Electric Railway Company, states that he did not sell the several miles of river bottom from Weverton to the Frederick county line, and that he intended himself to develop the project of furnishing power to Hagerstown and other towns by building an immense dam across the Potomac. He also stated that when his plant was in operation he expected to supply power on such a scale that he would be enabled to furnish the Hagerstown electric railway with enough to run its cars and light Hagerstown. Mr. Evans has just been granted by the Virginia Legislature the privilege of furnishing power south of the Potomac.

Knoxville, Tenn.—It is stated that the Knoxville Water & Electric Power Company expects to begin work on its dam and power house at an early day. The company proposes to build a dam on the Holston River about 4½ miles above its confluence with the French Broad, and erect electric generating works there the product of which will be transmitted to Knoxville for lighting and power purposes. Horace Van Deventer of Knoxville is the secretary and treasurer of the company.

Provo City, Utah.—On the 15th ult., says the Provo "Enquirer," "the wheels of the Telluride Power Transmission Company were set in motion, and the electric current flashed over the wires from Provo canyon to Mercur, a distance of thirty-five miles, the longest distance which power is continuously transmitted over wire in the United States, and only 8 per cent. of the power is lost after traveling that distance. The machinery will be kept in continual motion now."

St. Louis.—A company is forming in this city for the purpose of harnessing the water power of the Meramec River near Pacific, Mo., and building at that point a plant which will be sufficiently powerful to distribute light and power not only throughout the county and towns between St. Louis and Pacific, but to users of electricity in this city.

MINES.

Cumberland, Md.—The Davis Coal & Coke Company, at Thomas, W. Va., has completed its electric plant, and hereafter the yards and mines will be illuminated by electricity and coal will be mined and hauled to the surface by electric power.

Mammoth, W. Va.—C. C. Lewis is having a large electric power plant constructed. He has undertaken to furnish electric power to the mines of the Staunton Coal Company, the Thomas Sholz Company and the Kelly's Creek Coal Company. This plant, which is to cost about \$20,000, is being put in by a Chicago electrical company.

MANUFACTURING, ETC.

Cincinnati.—The Bullock Electric Manufacturing Company has decided to accept a site at Norwood for its new plant. A twelve-acre tract has been obtained which is conveniently located at the intersection of the Baltimore & Ohio and Cincinnati, Lebanon and Northern Railroads, and here will be erected a machine shop, brass foundry, power house and office buildings. The company, it is stated, will spend at least \$150,000 on buildings and machinery.

Omaha, Neb.—Thirteen car loads of electrical equipments brought from the Nashville Exposition have reached here and men have been set to work putting in the whole plant for the illumination of the Exposition grounds.

Pittsburg, Pa.—The "Times" states that "contracts have been received by the Westinghouse Electric & Manufacturing Company from the Campanhia Mineira de Electricidade, a company which controls extensive light and power concessions in Brazil, for the complete equipment of two big power plants erected by the company. Other contracts are promised from the great republic, as a wonderful activity in the establishment of electric plants has been shown."

Washington, D. C.—The District Commissioners have decided that under the law hotel power plants can no longer furnish service to other buildings.

COMPANY MATTERS.

Akron, O.—A deal has been closed whereby the Akron, Bedford & Cleveland and the Cleveland, Painesville & Eastern Electric Railway Companies are consolidated under one management in the operating department so as to secure harmony in connections. The following officers have been appointed to operate the consolidated roads: Superintendent, L. E. Beinstein; general passenger agent, Julius Mengensdorf; park superintendent, C. T. Bates. H. A. Everett, who was president of both companies, will be at the head of the consolidation.

Annapolis, Md.—A bill has been introduced in the House to incorporate the National Park, Silver Spring & Hyattsville Railroad Company, the capital stock to be not less than \$50,000 and subject to an increase to

\$100,000 by a vote of the stockholders. The incorporators named are Francis H. Smith, J. H. Raleton and Roger Bellis, of Prince George's County; B. G. Smith of Conowingo, Md.; Richard Martin, Jr., of Baltimore; Lewis H. Finney and John C. Davidson of Washington; John Leeds Bowie and H. Bradley Davidson of Montgomery County, Md.

Columbus, O.—The Columbus Electric Company, formerly the Columbus Electric Light & Power Company, organized on the 21st ult. by electing A. P. Lathrop president and treasurer; George W. Bright first vice-president, and W. S. Kelly second vice-president and consulting engineer. The other directors are: Fred W. Hubbard, L. P. Stevens, S. J. McClure, Thomas E. Knauss and W. H. Doane. The property will be put in first-class shape as regards power house, lamps and lines.

Knoxville, Tenn.—The city council has passed an ordinance authorizing the Knoxville Electric Light & Power Company to purchase, lease or consolidate, with the Mutual Light & Power Company.

Pittsburg, Kan.—The stockholders of the Pittsburg, Fontenac & Suburban Railway and the Weir City, Pittsburg & Columbus Electric Street Railway at a meeting in this city elected reorganization, in which the control of the line passes into the hands of Pittsburg men. The resignation of Leroy Simons, general superintendent, was accepted, and F. B. Wheeler, J. A. Gibson, M. O. Dick and Morris Cliggett of this city and Joseph Anderson, J. J. Tyler and Dr. Jones of West Chester, Pa., were chosen directors. Morris Cliggett was elected president. The line is now in a prosperous condition, and the new management will proceed at once with the extension of the road to Weir City and Columbus.

Valatie, N. Y.—The Columbia Electric Power Company has filed a certificate stating that its capital stock has now been all paid in. Its directors include Charles Wild, William H. Wild and George M. Pinney.

PERSONAL AND MISCELLANEA.

C. E. Scribner, the electrical inventor, of Chicago, and Herman Salt of the Western Electric Company, New York, were in New Orleans on the 22d ult., on their way—not to Cuba, but to Mexico.

The electrical engineers of St. Paul and Minneapolis, to the number of thirty-five, partook of their second annual banquet at the Windsor Hotel in St. Paul on the 21st ult. Morgan Brooks of Minneapolis presided and among the speakers was Prof. George D. Shephardson, who spoke for the electrical engineering department of the State. He suggested among other things a larger union among men of the craft through membership in the Association of Engineering Societies, which now carries on its rolls 1,200 names.

W. H. Milholland, secretary of the Citizens' Street Railroad Company, Indianapolis, has received the following letter, written by Walter W. Brown of that city. It speaks for itself: "Gentlemen—Some years ago, three or four, at different times, I neglected or rather refused to pay my fare by letting the conductor pass me by, when, if I had acted honestly, I would have paid him. One time I got off the car before he got to me, but when he called to me for fare I did not pay, because another conductor had made me pay for two squares when I had to get off a moment to see a man and take the next car. That was not his fault, however. I at another time lost my fare and the conductor let me ride home anyway. So I inclose you stamps to cover all that I think I ever got from your company in that way. I am now a child of God, and I see in His Word that we have all got to stand before Him and be judged—street car company and all—and I do want to be unblamable in holiness, without which no man can see God, before God, even our Father, at the coming of our Lord Jesus Christ with all His saints. Accept inclosed. Forgive my wrongs. Meet me at His coming with a pure heart." There was 30 cents in stamps in the letter.

Frank Renehan, of Washington, D. C., left Santa Fe, N. M., a few days ago for Bland, where he has been employed as electrician by the Bland Milling Company. This company is installing a complete electric plant for the recovery of gold and other metals by a new process, the invention of W. B. McPherson of San Francisco. Under this system gold, silver and copper are chemically dissolved and subsequently precipitated by an electric current. It is said that as a result of the process the gold gathers in one receptacle, the silver in another and the copper in a third. Much interest is manifested in the success of the plan which will revolutionize old methods.

S. F. Hazelrigg, general manager of the Atlantic Coast Electric Railway Company, who recently returned from an extended trip through Europe and South America, has been made manager of the Staten Island Rapid Transit Company and the Staten Island Electric Light Company. He was appointed on February 1, and has assumed full charge of the workings of the two companies. In addition to these positions, Mr. Hazelrigg will continue as general manager of the Atlantic Coast Company, with a residence in Asbury Park, N. J.

Howard Gould's new yacht, the Niagara, built by the Harlan & Hollingsworth Company, Wilmington, Del., will have an electric plant as complete as has ever been installed on board a ship. It will consist of two dynamos, each capable of furnishing 400 sixteen-candle power lamps, and a storage battery with a capacity of eighty lamps. When desired the dynamos can be made to operate 900 display lights at night, and also a powerful searchlight on the bridge. Electricity will be employed

in every conceivable way on board the Niagara. There will be electric heaters, curling tongs, smoothing irons, ranges, warming pans and lifts. Electricity will operate the laundry and drying rooms; it will heat chafing dishes and bring out the music of the big orchestra. The ship will be electrically heated throughout.

RECENT COMPANY ELECTIONS.

Belvidere Electric Light Company, Belvidere, Ill.—President, F. W. Plane; vice-president, M. C. Marian; manager, D. B. Pettit; secretary, J. R. Balliet; treasurer, Beecher Sands.

Cohoes City Railway Company, Cohoes, N. Y.—Directors: Robert O. Pruyn, Edgar S. Fassett, George S. Turner and Thomas I. Van Antwerp.

Consolidated Railway Company, Baltimore.—Directors: Nelson Perin, Charles Adler, E. L. Bartlett, H. Crawford Black, William T. Dixon, T. Edward Hambleton, William P. Harvey, Jesse Hilles, William A. House, George O. Jenkins, George A. Von Lingen and Theodore F. Wilcox. President Nelson Perin, Vice-President and General Manager W. A. House and the other officers were re-elected.

Fulton Electric Light & Power Company, Fulton, Ill.—President, Mrs. Mary R. Lockheart; vice-president, Dr. D. W. Ward; treasurer, Edmund Jackson; secretary and manager, John C. Martindale; electrician, George A. Walter.

Lansoning Electric Light & Power Company, Lansoning, Md.—President, William Atkinson; secretary-treasurer, Hugh Scott; directors: Wm. Atkinson, Hugh Scott, George Schantz, Jr., John McFarlane, Sr., and George Tennant.

Louisville City Railway Company, Louisville, Ky.—President, J. B. Speed; vice-president, St. John Boyle; general manager, T. J. Minary; secretary, J. M. Pettus; directors: J. B. Speed, H. H. Littell, St. John Boyle, A. P. Humphrey, John States, J. W. Gaubert, Harry Bishop, T. J. Minary and A. H. Davis.

Waterford & Cohoes Railway Company, Cohoes, N. Y.—Directors: Thomas Bresline, Thomas Knickerbocker, Charles Clemenshaw, William Kent, Otis G. Clark, William Shaw, Francis N. Mann, Jr., Frank Peck, C. C. Ormsby, J. J. Hagen.

Madison Electric Railway Company, Madison, Wis. (reorganization).—President, F. W. Oakley, Madison; vice-president, George S. Russell, Cleveland; secretary and

The Brake in Railway Service.

This is the age of high speeds for nearly every class of railroad service, both steam and electric. Many are the devices for applying the brakes to the wheels, but it has remained for J. Hector Graham, General Manager of the Graham Equipment Company, to perfect his Brake Equalizing Bar to which the brake beams of the trucks are hung, and which effectually prevents all tilting of the truck frame and the disagreeable backlash of the car body when a sudden application of the brakes is made with a full load. (See cut of truck.)

Many people have been thrown from electric cars and seriously injured by the brakes being applied and then suddenly released when the car was moving at a high rate of speed. The sudden application tilts the truck frame and the sudden release gives a tremendous rebound to the car body. All this Graham's Equalizer overcomes. On nearly every steam and electric car truck, no matter what service it is in, the brake beams are supported from the truck and sills by a wrought iron link made of $\frac{3}{4}$ inch half round iron. This is fastened in an iron clip to the truck end sills and in the cast-iron brake head. The constant vibration of the truck, with the many applications of the shoes to the wheels, wears the contact parts of link, clip and brake head, so that in time when the brakes are applied the shoes slip up and down on the wheels causing a clatter and hammering, greatly annoying the passengers.

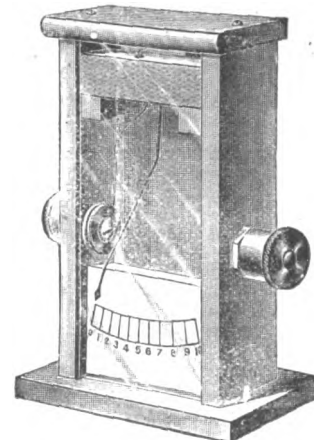
Graham has discarded these old-fashioned brakes, and uses a $\frac{3}{8}$ inch round steel rod with flexible rubber cushions, entirely preventing all clatter and reducing the locking of the wheels to a minimum. (See cut of truck.)

Again, with the present method of hanging the brake beams from the track sills, when the car is loaded the shoes are carried down under the wheels, lengthening out the brake rods and requiring more turns of the brake handle or more piston travel of the air cylinder to make a stop. Graham's Equalizer carries the shoes up an inch on the wheels for every inch the load deflects the truck frame, so that when a car is loaded it is much easier to stop the car than when empty.

The Brake Equalizer can be applied to all makes of

business for all there is in it, and judging from the excellent quality of the goods he is now turning out, his lamps cannot help but become popular and create a large demand.

Any one desirous of obtaining electrical measuring instruments would do well to address the Cherry Electric Works, 25 and 27 Third Avenue, New York. This concern has recently placed upon the market an inexpensive but accurate voltmeter reading from 0 to 10 volts and an ammeter reading from 0 to 10 amperes. The price of these instruments is but \$1.50 each, and for experimental purposes,



CHERRY'S VOLTMETER.

where the standard instruments would prove too expensive, these will be found both valuable and trustworthy. The mechanism is enclosed in a hardwood case, which gives them an extremely neat and handsome appearance. There is no doubt but what these instruments fill a long-felt want, as many amateurs have been kept from experimenting owing to the cost of the standard instruments.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address: Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

INCORPORATIONS.

The Sonoma Electric Light Company, Sonoma, Cal. Capital stock, \$10,000; subscribed, \$3,250.

The Meyersdale Electric Light, Heat & Power Company, Meyersdale, Pa. Capital stock, \$10,000.

The La Salle County Railway Company, Streator, Ill. Capital stock, \$500,000. Incorporators: W. H. Boys and W. H. Holcomb.

The American Motor Syndicate, Chicago. Capital stock, \$2,400. Incorporators: Theron E. Dixon, D. H. Fletcher and J. S. McGregor.

The bill providing a charter for the Consolidated Railway & Electric Power Company of Roanoke, Va., has passed the Virginia Senate.

The Belmont Gas & Electric Fixture Manufacturing Company, Belmont, Ill. Capital stock, \$2,500. Incorporators: S. H. Ales and Richard E. Burke.

The Merced Falls Electric Company, Merced, Cal. Capital stock, \$100,000. Incorporators: James G. Ruddle, E. D. N. Lehe, James T. Peck, J. D. Bradley and O. E. Green.

The Flushing Electric Light & Power Company, Flushing, N. Y., has certified to an increase of capital stock from \$100,000 to \$250,000. The liabilities of the corporation are \$151,159.

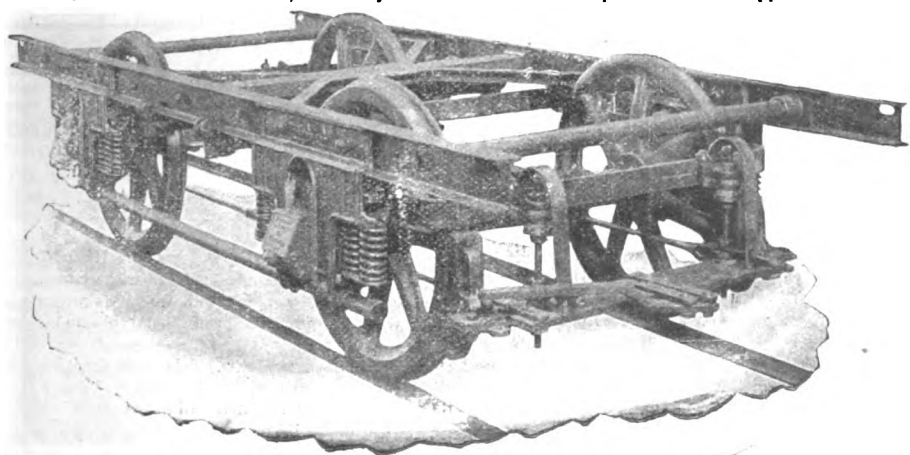
The Muncie Electric Light Company, Muncie, Ind. Capital stock, \$25,000. Directors: Charles H. Kembrough, William H. Wood, H. Clay Haymond, Melville Wood and Hal C. Kembrough.

The Ward Leonard Electric Company, Bronxville, N. Y., to manufacture electrical appliances. Capital stock, \$100,000. Incorporators: H. Ward Leonard, Charles E. Carpenter, Richard H. Mansfield, Jr., and Henry P. Bull.

The Borough of Brooklyn Gas Company, Brooklyn, N. Y., to manufacture and sell gas for lighting purposes and to manufacture and use electricity for producing light, heat and power. Capital stock, \$500,000. Directors: Samuel B. Lawrence, Francis P. Lowrey and Armitage Mathew, of New York, and Henry M. Haviland and John E. Summerfield, of Brooklyn.

The Warren-Medbery Company, Sandy Hill, N. Y., to manufacture electrical supplies. Capital stock, \$25,000. Directors: Horace J. Medbery and S. C. Medbery, of Ballston Spa; H. B. Warren, of Yonkers, and W. H. Cunningham, H. E. Tidmarsh, Lincoln Paris and G. W. Wait, of Sandy Hill. The officers are: President, H. J. Medbery; secretary and treasurer, George W. Wait; general manager, H. E. Tidmarsh. The special dynamo to be made is the invention of Mr. Warren, and generates incandescent and arc currents.

The Sherwood Car Fender Company has been incorporated at Trenton, N. J., with a capital stock of \$400,000, all paid in. It is to manufacture car fenders and other car ap-



GRAHAM ROLLED STEEL TRUCK.

treasurer, H. R. Newcomb, Cleveland; directors: the president, vice-president and treasurer; T. H. Wilson, Cleveland; P. L. Spooner and J. H. Palmer, Madison; S. M. Hammell, Schenectady, N. Y.

COMMERCIAL PARAGRAPHS.

The Ward Leonard Electric Company, Bronxville, N. Y., advise us that the circuit breaker business has grown to such dimensions that they have been obliged to make tools for all the different operations and have perfected them to such a degree that all the parts are interchangeable and any part can be replaced or duplicated out of stock at once.

Mr. W. J. Wollman, a well-known member of the Chicago Stock Exchange, begs to announce that he has moved permanently to New York and has opened an office at 20 Broad street, where he is prepared to carry on a general brokerage business. Mr. Wollman's success in Chicago is a guarantee that any prospective investors who purchase securities through him will be well treated.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The Eureka Tempered Copper Company, since the removal of their New York offices from 511 and 513 West 13th street to more spacious quarters at 107 Liberty street, are doing a brisk business, their product being especially desirable for commuters, commuter segments, bearings of all kinds, and in fact for all devices in which pure copper without alloys, but sufficiently tempered for all mechanical purposes, is wanted. This is probably the only firm that can supply tempered copper at such a reasonable price as to bring it within the reach of all.

truck, both steam and electric, and in view of the crude methods now in operation it would be well for all builders of electric trucks to write to the Graham Equipment Company, Boston Mass., for terms, as they are ready to license any company to apply it to their trucks.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

"Shade Lamps" is the title of a very dainty little catalogue just issued by the Electric Appliance Company, Chicago, covering their special lines of Esperen, Klemm and Dale electric portables and shade lamps. It is a valuable catalogue for any user or dealer in these goods and will be sent on application.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Although the Edison Junior "Improved" Incandescent Lamps have only been on the market a comparatively short time, large quantities of them are being sold, and at the general offices of Mr. Thomas A. Edison, Jr., 96 Broadway, New York, business is reported as being exceedingly brisk. These lamps, the filaments of which are made by a new process, are manufactured at Shelby, Ohio, and can be obtained of almost any desired color. Mr. Edison, Jr., now has branch offices established at 60 State street, Boston, at St. Paul, Minn., at Los Angeles, Cal., at Norfolk, Va., at Austin, Tex., and at Santiago de Cuba. It can readily be seen that Mr. Edison, Jr., is pushing the lamp

TELEPHONE AND TELEGRAPH.

pliances. The principal incorporators are Carl Sherwood and Judson J. Curtis of Honesdale, Pa., and Charles H. Bonner of Brooklyn, N. Y.

The Citizens' Electric Company, Eureka Springs, Ark.—to operate a plant or plants for electric light, heat, ice and power purposes. Capital stock, \$25,000. Incorporators: W. M. Duncan, A. R. Sayles and L. P. Badger.

The Standard Traction Company, Philadelphia. Capital stock, \$1,000. Incorporators: Maynard L. Young, Edwin F. Morse, William S. Doran, J. Howard Reber and William F. Sullivan.

The Columbus Electric Company, Columbus, O.—to supply electricity for power and for lighting the streets and public and private buildings of the city of Columbus and the territory contiguous thereto; manufacturing, selling and furnishing the electric light and power required therein for such purposes; constructing lines for conducting electricity for power, light and other purposes, and doing such other things as usually appertain to the business of electric companies. Capital stock, \$750,000. Incorporators: Irvin Butterworth, Walstein F. Douthirt, Chas. S. Ritter, Arthur R. Bliss and Irving M. Seleger.

The Wilmington & Chester Traction Company has filed articles of incorporation in the Camden County clerk's office, Camden, N. J. The objects of the corporation are to build, construct and operate electric railways. Capital stock, \$2,000,000; paid in, \$1,000. Incorporators: Henry C. Moore, Trenton; Henry A. McCarthy, Ridley Park; Richard Nichols, Germantown, Pa.; Clarence Sill, Darby, and Charles Martindale, Camden, N. J.

The Germantown & Fairmount Park Street Railway Company, Philadelphia— to build and operate a street railway. Capital stock, \$80,000. Incorporators: Charles E. Morgan, W. Rotch Wister, William G. Warden, Josiah M. Bacon, Samuel T. Bodine, Richard Ashhurst, Joseph Bushnell, William Wharton, Jr.

The Bonanza Power & Land Company, Pocatello, Idaho—to improve lands by irrigation, operate mines and build an electric railroad from Shoshone to Great Shoshone falls. Capital stock, \$500,000. The incorporators are ex-Governor Rickards of Montana, ex-Lieutenant Governor Bierbover of Idaho, J. P. Parrine, owner of the celebrated Blue Lakes farm, Joseph Wildran of Shoshone, Idaho, and F. R. Thomas and J. J. Cusick of Butte.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED FEBRUARY 22, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 599,344. Electric-Railway System. John M. Murphy, Torrington, Conn., assignor, by direct and mesne assignments, to the Safety Third Rail Electric Company of New Jersey. Filed Sept. 24, 1897.
- 599,393. Trolley for Electric Railways. Edward K. Landis, Philadelphia, Pa. Filed March 5, 1897.
- 599,580. Switch-Operating Mechanism. Charles W. Yerbury, Newark, N. J. Filed Oct. 6, 1897.
- 599,604. Electric-Railway System. James D. Gibbs, Chicago, Ill. Filed March 14, 1896.
- 599,470. Car Fender. Inozens J. Neracher, Cleveland, O. Filed Sept. 12, 1896. Renewed July 6, 1897.
- 599,650. Safety-Guard for Railway-Cars. Abel M. Phelps, New York City. Original application filed Jan. 8, 1894. Renewed Nov. 26, 1895. Divided and this application filed April 21, 1894. Renewed Nov. 4, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 599,480. Electric Arc Lamp. Orville B. Skinner and Geo. M. Bacon, Cleveland, O., assignors of one-third to George G. Wells, same place. Filed Aug. 27, 1897.
- 599,519. Radiator Attachment for Arc-Lamps. Henry Stenz and George Westermann, Faribault, Minn., assignors to the Shadowless Radiator Manufacturing Company, same place. Filed Nov. 30, 1896.
- 599,543. Support for Incandescent Electric Lights. John Whitaker, Schenectady, N. Y. Filed June 19, 1897.
- 599,635. Electric Arc Lamp. Henry J. Sage, Rochester, Pa. Filed March 13, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 599,322. Individual Telephone Call. Thomas C. Drake, Malta, Ohio, assignor, by mesne assignments, of one-third to James M. Rusk, McConnellsville, Ohio. Filed July 2, 1894.
- 599,533. Telephone-Switchboard Apparatus. Cleveland F. Dunderdale, Chicago, Ill., assignor of one-half to John F. Pershing, same place. Filed July 31, 1896.

BATTERIES.

- 599,315. Secondary Battery. Walter A. Crowder, Chicago, Ill. Filed Jan. 25, 1897.
- 599,405. Electric Battery. Charles P. Shrewsbury, London, and John L. Dobell, Modbury, England. Filed Dec. 24, 1895.
- 599,411. Electrical Primary Battery. Joseph B. Whittemore, London, England. Filed Sept. 8, 1896.

MISCELLANEOUS.

- 599,316. Electric Igniter for Gas-Engines. Fitz E. Culver, Chicago, Ill. Filed Feb. 15, 1897.
- 599,316. Electric-Wire-Holding Appliance. Hugh A. McCoy, Cambridge, Mass. Filed Sept. 30, 1897.
- 599,351. Electric Resistance Conductor. Henry G. O'Neill, Brookline, Mass., assignor to the American Electric Heating Corporation, Boston, Mass. Filed Jan. 4, 1897.
- 599,352. Electric Resistance-Conductor. Henry G. O'Neill, Brookline, and Horace B. Gale, Boston, Mass., assignors to the American Electric Heating Corporation, Boston, Mass. Filed Jan. 4, 1897.
- 599,354. Electric Igniter for Explosive-Engines. Hubert F. Probst, Chicago, Ill. Filed April 8, 1897.
- 599,455. Apparatus for Producing Ozone. Marius Otto, Paris, France. Filed June 15, 1897.
- 599,508. Driving-Gear for Electric Motors. George A. LeFebvre, New York City. Filed April 21, 1897.
- 599,654. Fire-Alarm Box. John H. Hayes, Appleton, Wis., and Charles Fisher, Chicago, Ill. Filed Jan. 21, 1897.

DESIGN.

- 24,309. Meter-Case. William D. Marks, Philadelphia, Pa., assignor to the American Electric Meter Company, same place. Filed Nov. 27, 1896.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

George H. Atkinson, lately manager of the Hudson Telephone Company, and a former manager of the Newark Telephone Company, was arrested in Jersey City on Wednesday night last week in civil proceedings brought by Robert Baker, of Brooklyn, to recover 550 shares of stock of the Newark Telephone Company. Baker alleges that in the latter part of March, 1896, he bought the stock from Atkinson at \$10 a share, and left it with him in trust, taking Atkinson's receipt for it, and that when he demanded the stock, which is now worth \$1,500, Atkinson refused to surrender it. Sheriff Heller held Atkinson in \$5,000 bail. Several other suits on various charges are pending against Atkinson.

The special committee on telephone service and charges of the Wholesale Grocers' Association of New Orleans have submitted their report. In it they say: "Your committee is clearly of the opinion that the present service is inferior for the price paid, and that the metallic or up-to-date circuit (designated as long-distance circuit) should have been furnished long since without extra cost, and under these circumstances the committee would recommend that every encouragement be given to a proper movement looking to improved service upon reasonable terms."

Senator Foster's bill in the New Jersey Senate limits telephone charges in first-class cities to \$1 per month, in second class cities to \$3 and in all other municipalities to \$2.50, and provides that the rate at public stations for local messages shall not exceed 10 cents for five minutes' talk. If these charges fail to net a company 8 per cent. net profit, it is provided to have an investigation made and to have charges regulated so as to yield that profit. The act makes provision for annual reports from the companies.

"It is rumored," says the Charleston, S. C., *News and Courier*, "that the network of telephone lines all over Marion and Marlboro counties in this State and some points in North Carolina will soon be extended to Cheraw. The gap between these lines and the Chesterfield line is only seven miles, and with the building of this and a little short one from Chesterfield to Movven connection will be completed from Charlotte to Wilmington, taking dozens of points in South Carolina."

At a mass-meeting of citizens held in the court house at Winchester, Tenn., a committee was appointed, consisting of F. A. Pattie, S. M. Alexander and George E. Banks, to investigate and report whether or not it was to the best interest of the town to organize a local telephone company or to encourage the East Tennessee or Cumberland Telephone Companies to establish an exchange in the town.

The Cumberland Telephone Company, having absorbed the Great Southern Telephone & Telegraph Company, will connect the Louisiana system of the Great Southern with its own, which covers not only Tennessee but a part of Kentucky, by building south from Memphis. The line of the Illinois Central Railroad will be followed. A new switchboard will be placed in the exchange at New Orleans and a much improved service in that city is promised.

It is stated that if the citizens should win their suit in Omaha against the Nebraska Telephone Company for reduction of tolls from \$5 to \$3, and the company should refuse to comply with the law, an Eastern syndicate stands ready to put in a telephone system in that city and furnish efficient service at the low rate.

The officers of the Buffalo Telephone Company, incorporated on the 19th ult., say they will begin operations just as soon as a franchise is secured in Buffalo. Application for the franchise has been made to the aldermen. This is the second telephone corporation organized in Buffalo within a few weeks, the Western New York Telephone Company being the other.

Edgar L. Miller of Frederick, Md., general manager of the Interstate Telephone & Telegraph Company, was at Wilmington, N. C., a few days ago arranging to carry out the plan of the company to place Wilmington in connection with its long distance circuit, connecting that city with Goldsboro, Raleigh, Durham and other cities.

The *Plaintdealer* of Wabash, Ind., states that nearly all the additional issue of the Home Telephone Company's stock, which it was proposed to issue to retire the outstanding obligations incurred on construction account, has been taken, and the \$5,000 in certificates will be issued in a few days.

The Keystone Telephone Company of Pittsburg, Pa., has proposed to the board of Trade of Latrobe, Pa., to remove its plant to the latter place for a cash bonus of \$10,000.

A telephone company has been organized by the citizens of Pathville, Franklin county, Pa. Their purpose is to

run a line from Richmond, Franklin county, to Blair's Mills, Juniata county, a distance of twenty-two miles.

The Lansing, Mich., telephone exchange has made connection with the Central Telephone Company's new metallic line between Grand Rapids and Chicago. Lansing will have connection with 13 county seats not now accessible. By spring the line will be extended to Fort Wayne.

Formal demand having been made by Senator Brush for immediate action by the Senate Finance Committee on the bill introduced by him for the New York Board of Trade, providing for a reduction in telephone rates, the committee met Thursday of the present week for a hearing on the bill.

The Colorado Telephone Company is erecting a new exchange at Denver, which will be fitted with all the modern improvements and will have a capacity for 2,100 subscribers. A reduction in rates is promised when the new station is completed. E. B. Field, the general manager, was recently made a director.

The District Commissioners at Washington, D. C., have decided to report favorably on the bill to authorize the Automatic Telephone Exchange Company, Limited, to install and operate a system of telephones in Washington. The bill has been introduced in the Senate.

Two new ordinances were introduced in the Chicago city council last week. One has for its object the establishing of long-distance telephone stations in conjunction with a Wisconsin long-distance company, and the other ostensibly provides a competitor for the Chicago Telephone Company.

The Railway Commission at Raleigh, N. C., on the 18th ult., after hearing the argument of Senator Daniel, counsel for the Bell Company, overruled the exceptions of the company to the order reducing telephone rates. The Bell Company gave notice of appeal.

At Fulton, N. Y., a new company has been organized to be known as the Fulton Telephone Company. The officers are: President, Dr. I. C. Curtiss; first vice-president, George C. Webb; secretary, Elmer E. Summey; treasurer, James K. Whittaker of New York.

The Pittsburg *Dispatch* says the Home Telephone Company will be reorganized and will secure a Pennsylvania charter. The sale of the company's property in Pittsburg was announced in our financial column last week.

The Barnesville (O.) Telephone Company has sold out to the Central District and Printing Telegraph Company of Pittsburg, Pa., which will now build a long distance line from Wheeling to Cambridge, O., connecting the towns en route.

New Companies Incorporated.

The Dunkirk & Fredonia Telephone Company, Dunkirk, N. Y. Capital stock, \$40,000. Directors: Robert J. Moorhead of Northeast, Penn.; J. C. Moorhead of Cleveland; S. Fred Nixon of Westfield, N. Y.; M. A. Phelps, F. W. Plato and G. H. Frost of Buffalo, and S. B. Rawson of Elyria, Ohio.

The Mankato Citizens' Telephone Company, Mankato, Minn. Capital stock, \$25,000. Incorporators: Lorin Gray, H. E. Hance, W. A. Funk, J. H. James, Ed. I. P. Stade, F. Kron, H. A. Patterson, John C. Wise, Jr., A. G. Bierbauer, John Klein, J. B. Meagher, O. W. Schmidt, W. N. Plymat and Nic Peterson.

The Knickerbocker Telephone & Telegraph Company, New York—to operate in New York City and extend its lines to Rouse's Point, Ogdensburg, Buffalo, Montauk Point, Fire Island, Weehawken, Hoboken, Jersey City, Bayonne, Elizabeth, Perth Amboy, Paterson, Newark, Orange, Plainfield, New Brunswick and Long Branch. Capital stock, \$7,500,000. Directors: Samuel B. Lawrence, Francis P. Lowrey, John B. Summerfield, Henry M. Haviland, Charles L. Horton, George E. Spencer and Henry C. Everdell, all of New York City.

The Buffalo Telephone Company, Buffalo, N. Y.—to operate a telephone line in Buffalo, to Lockport, Medina, Albion, Brockport, Rochester, Depew, Lancaster, Akron, Batavia, Churchville, Tonawanda, North Tonawanda, LaSalle, Niagara Falls, Suspension Bridge, Lewiston, Youngstown, Hamburg, Angola, Silver Creek, Dunkirk, Erie, Pa., Ashtabula and Cleveland, O., and also in the cities and villages other than those mentioned in Erie, Niagara, Orleans, Genesee, Livingston, Wyoming, Monroe, Chautauque and Cattaraugus counties, N. Y. Capital stock, \$500,000. Directors: George K. Birge, Daniel N. Lockwood, C. E. Williams, L. B. Crocker, William H. Kinch, Joseph Kennedy, William B. Hoyt and R. J. Getz of Buffalo.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mfg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Feb. 28:						Hartford Conn.—Feb. 28:					
Albany Ry. Co.....	100	2,000,000	\$1,750,000 1% Q. Aug. '97.	133 1/2	184 1/2	Hartford Street Ry. Co.....	100	\$2,000,000	\$200,000 3% S., July, '97.	140	..
Troy City Railway Co.....	100	2,000,000	2,000,000 1% Q., Sept. 10, '97.	72	..	Hartford & West Hartford RR.....	100	1,000,000	247,000 ..	..	..
Traction Co. (Saratoga).....	100	50,000	50,000 ..	..	..	Holyoke Mass.—Feb. 28:					
Allentown, Pa.—Feb. 28:						Holyoke Street Ry. Co.....	100	400,000	400,000 3% A., July, '97.	200	205
Allentown & Lehigh Val. Trac. Co.....	4,000,000	1,500,000	..	..	80	Hoboken, N. J.—Feb. 28:					
Bridgeport, Conn.—Feb. 28:						North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000 8%, 1892.	70	..
Bridgeport Traction Co.....	100	2,000,000	2,000,000 1% Aug., '97.	45	60	Indianapolis, Ind.—Feb. 28:					
Baltimore, Md.—Feb. 28:						Citizens' Passenger Ry.....	5,000,000	5,000,000	..	25	26
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000 5% S., July 2, '97.	59	70	Lancaster, Pa.—Feb. 23:					
Baltimore Traction Co.....	25	10,000,000	5,750,000 1% Q., Jan., '97.	23 1/2	24	Pennsylvania Traction Co.....	100	10,000,000	9,900,000 ..	..	..
Central Ry. Co. of Baltimore City..	50	800,000	800,000 6% A., 1897.	83	82 1/2	Lancaster & Col. Electric Ry.....	..	..	87,500 ..	..	..
Civ. & Suburban Ry. Co.....	50	4,000,000	1,000,000 2% A., Jan., '97.	48	..	West End Street Railway.....	..	..	..	..	..
Boston, Mass.—Feb. 28:						Louisville, Ky.—Feb. 28:					
New England Street Ry.....	25	5,000,000	1,081,925 1% Q., Jan. 15, '97.	..	..	Louisville Ry.....	100	4,000,000	4,000,000 1% Q., Apl., '97.	85	87
North Shore Traction Co.....	100	4,000,000	4,000,000 3% S., Oct., '96.	13	15	Louisville Ry.....	100	2,000,000	2,000,000 2 1/2% S., Apl. 1, '97.	94	96
North Shore Traction Co.....	100	4,000,000	2,000,000 6% S., A. & O.	76	78	Minneapolis, Minn.—Feb. 28:					
West End Street Ry. Co.....	50	10,000,000	9,085,000 4% S., Oct., '97.	83	83 1/2	Twin City Rapid Transit.....	100	17,000,000	15,010,000 ..	17 1/2	20
West End Street Ry. Co.....	50	6,400,000	6,400,000 4% S., Oct. 1, '97.	102 1/2	103	Twin City Rapid Transit.....	8,000,000	1,137,200	1% Q., Apl., '97.	..	100
Brooklyn, N. Y.—Feb. 28:						Montreal, Canada.—Feb. 28:					
Brooklyn City & Newtown Ry.....	100	2,000,000	1,000,000 2 1/2% Aug. 1, 1897.	172	180	Montreal Street Ry. Co.....	50	4,000,000	4,000,000 8% S., M. & N.	260 1/2	260 1/2
Brooklyn Rap. Transit Co., tr. certif..	100	20,000,000	20,000,000 ..	40	40 1/2	Toronto Street Ry. Co.....	100	6,000,000	6,000,000 1 1/4% S., J. & J.	98 1/2	99 1/2
Brooklyn Heights Railroad.....	100	200,000	200,000 ..	..	..	Memphis, Tenn.—Feb. 28:					
Brooklyn City RR.....	100	12,000,000	12,000,000 2 1/2% Q., July, '97.	197	200	Citizens' Street Railway Co.....	100	1,500,000	1,500,000 ..	16	..
Brooklyn, Queens Co. & Sub. RR.....	100	2,000,000	2,000,000 ..	..	..	New Haven, Conn.—Feb. 28:					
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000 1 1/4% July 1, '97.	150	160	Fair Haven & Westville RR.....	25	1,500,000	900,000 4% S., Sept. '96.	57	60
Kings County Elevated.....	100	4,750,000	4,750,000 ..	..	..	New Haven Street Railway Co.....	100	1,250,000	1,000,000 2 1/2% A., July '96.	60	80
Kings County Traction Co.....	100	4,500,000	4,500,000 1 1/2% July 26, '97.	43 1/2	50	New Haven & Centerville.....	100	700,000	800,000 ..	..	..
Nassau Electric Railroad.....	50	6,000,000	6,000,000 ..	42	..	Winchester Avenue RR.....	25	1,000,000	600,000 ..	40	42
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000 ..	74	80	New Orleans, La.—Feb. 26:					
Brooklyn, B. & W. R. Railroad.....	1,000,000	1,000,000	..	..	..	Canal & Claiborne RR. Co.....	40	240,000	240,000 2% Q., July, '96.	140	150
Buffalo, N. Y.—Feb. 28:						New Orleans & Carrollton RR.....	100	1,200,000	1,200,000 1% Q., Apl., '97.	124 1/2	128
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000 ..	60	62	New Orleans Traction Co.....	100	5,000,000	5,000,000 ..	..	..
Buffalo Railway Co.....	100	6,000,000	5,370,500 1% Q., Sept., '97.	82	84	New Orleans Traction Co.....	100	2,500,000	2,500,000 6% S., J. & J.	9	15
Columbus O.—Feb. 28:						Orleans Traction Co.....	100	2,000,000	2,000,000 3% S., July, '97.	..	62
Columbus Street Railroad.....	100	8,000,000	8,000,000 1% Q., Feb., '97.	45	48	New Or. City & Lake RR.....	100	2,000,000	2,000,000 4% S., July, '97.	..	95
Columbus Central Street Railroad.....	100	1,500,000	1,500,000 ..	..	..	Orleans Railroad.....	50	500,000	185,000 1% Q., June, '94.	10 1/2	11
Charleston, S. C.—Feb. 28:						St. Charles Street Railway.....	50	1,000,000	1,000,000 1 1/2% Q., Apl., '97.	55	67
Charleston City Ry. Co.....	50	100,000	100,000 3% S., Jan., '97.	..	..	New York—Feb. 28:					
Enterprise City RR. Co.....	25	1,000,000	250,000 ..	..	..	Central Crosstown RR.....	100	600,000	600,000 2% Q., July, '97.	230	..
Chicago, Ill.—Feb. 28:						Christopher & 10th Sts. RR. guar.	100	650,000	650,000 2% Q., Apl., '97.	155	165
Chicago City Ry. Co.....	100	12,000,000	12,000,000 3% Q., Sept. 15, '97.	235	237	Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000 1 1/2% Q., Feb., '97.	140 1/2	143 1/2
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800 ..	12 1/2	12 1/2	Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000 1 1/4% Q., July, '97.	..	85
Lake Street Elevated RR.....	100	10,000,000	10,000,000 ..	..	..	Broecker St. & Fulton Ry. guar.	100	900,000	900,000 3% A., July, '97.	83	85
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000 ..	..	..	Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2 1/2% Q., July, '97.	215	..
Met. West Side El. const. stk.....	100	15,000,000	2,500,000 ..	..	..	Can. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2% Q., July, '97.	170	180
North Chicago Street RR.....	100	10,000,000	6,000,000 3% Q., Oct., '97.	220	225	Eight Avenue RR.....	100	1,000,000	1,000,000 ..	320	335
North Chicago City RR.....	100	500,000	249,900 ..	..	..	42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2% Q., Aug., '97	330	350
South Chicago City Railway.....	100	2,000,000	1,607,200 ..	..	..	Ninth Avenue RR.....	100	800,000	800,000 ..	180	190
West Chicago St. RR. Co.....	100	20,000,000	13,189,000 1 1/2% Q., May, '97.	97 1/2	97 1/2	Sixth Avenue RR.....	100	2,000,000	2,000,000 ..	195	210
Chicago West Div. Ry.....	100	1,250,000	624,900 3% S. ..	..	..	Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4 1/2% Q., Aug., '97.	800	825
Chicago Passenger Ry.....	100	2,000,000	2,000,000 5% S. ..	..	..	Third Avenue RR.....	100	2,500,000	1,862,000 1 1/2% Q., Jan., '97.	165	170
Cincinnati, Ohio.—Feb. 28:						42d St. Manhattan & St. Nich. Av.	100	2,500,000	2,500,000 ..	187	184
Cincinnati Inc. Plane Ry.....	50	1,000,000	575,000 ..	..	20	Union (Huckleberry) Ry.....	100	2,000,000	2,000,000 ..	70	78
Cincinnati Inc. Plane Ry.....	50	150,000	150,000 2 1/2% Q., Feb., '98.	..	75	Newark N. J.—Feb. 28:					
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000 ..	23	25	Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000 ..	42 1/2	43
Cincinnati Street Ry. Co.....	100	18,000,000	14,000,000 1 1/4% Q., July, '97.	115 1/2	116	Newark Passenger Ry.....	100	6,000,000	6,000,000 ..	180	185
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1 1/4% Q., Oct., '96.	..	..	Rapid Transit Street Ry.....	100	504,000	504,000 1 1/4% A. ..	..	..
Cleveland, Ohio.—Feb. 28:						Pittsburg, Pa.—Feb. 28:					
Arvon, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000 ..	40	42	Allegheny Traction Co.....	50	500,000	500,000 ..	..	48
Cleveland City Ry.....	100	8,000,000	7,600,000 3/4% Q., Oct., '97.	59	60	Consolidated Traction Co.....	50	15,000,000	15,000,000 2% Jan., '96.	14	14 1/2
Cleveland Electric Ry.....	100	12,000,000	12,000,000 3/4% Q., Oct., '97.	51 1/2	52 1/2	Consolidated Traction Co.....	50	15,000,000	15,000,000 3% May, '97.	46 1/2	..
Detroit, Mich.—Feb. 28:						Central Traction Co.....	50	1,500,000	1,500,000 ..	..	..
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000 ..	100 1/2	..	Citizens' Traction Co.....	50	8,000,000	13,000,000 6% A. ..	..	62
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000 5% July, '96.	175	..	Duquesne Traction Co.....	50	8,000,000	13,000,000 3% A. ..	..	..
Rapid Railway Co.....	100	250,000	250,000 ..	..	100	Pittsburg Traction Co.....	50	2,500,000	1,900,000 3% Aug., '96.	..	..
Detroit Electric Railway.....	100	1,000,000	1,000,000 ..	..	..	Federal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000 3% Aug., '96.	..	..
Wyandotte & Detroit River Ry.....	100	250,000	200,000 ..	100	110	Pgh., Allegheny & Man. Trac. Co....	50	8,000,000	12,934,889 2 1/2% Aug., '95.	..	24 1/2
Dayton O.—Feb. 28:						Pittsburg & Birmingham Trac. Ry..	25	3,000,000	3,000,000 1% Jan., '96.	18 1/2	..
City Railway Co.....	100	1,500,000	1,470,600 1 1/4% Q., Oct. 1, '96.	100	102	Pittsburg & West End Ry.....	50	1,500,000	1,500,000 3% A., June 30, '96.	..	..
City Railway Co.....	100	600,000	600,000 1 1/4% Q., Oct. 1, '96.	140	145	Second Avenue Traction Co.....	50	4,000,000	14,000,000 ..	..	..
People's Street Railway.....	100	1,100,000	..	100	..	Suburban Rapid Transit Co.....	50	800,000	200,000 ..	..	..

* Unlisted. † Ex div.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h \$200 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.
 i \$200,000 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k \$50 per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$225,000 of stock owned by West Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 8% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Crosstown Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavyonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Railway for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 8% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October, 1897.
 s Leased to Consolidated Traction Company for 7% on capital stock after October, 1897.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.	NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.
		Authorized.	Issued.						Authorized.	Issued.			
New Bedford Mass.—Feb. 28:							Boston, Mass.—Feb. 28:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2 % Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	28,850,000	4 % Q. Oct. '97	257	258
Northampton, Mass.—Feb. 28:							Erie Telegraph & Telephone Co.....	100	.....	.....	1 % Q. Aug. '97.	68	69
Northampton Street Ry.....	100	800,000	225,000	5 % A., July, '97.	165	175	New England Telephone Co.....	100	10,894,800	10,804,000	\$1.25 sh. Q.	128	...
Omaha, Neb.—Feb. 21							New York.—Feb. 28:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co.....	100	14,000,000	14,000,000	1 % Q.	91	...
Paterson, N. J.—Feb. 28.							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1 % Q.	105	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	88	85	*Commercial Cable Co.....	100	10,000,000	10,000,000	1 % Q.	180	190
Providence, R. I.—Feb. 28:							Franklin Tel. Co.....	100	1,000,000	.....	1 % Q.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	60	65	Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 % Q. Aug. '97.	71	71 1/2
Philadelphia.—Feb. 28:							*Gold & Stock Tel. Co. guar. 6 %	100	5,000,000	.....	1 % Q.	107 1/2	110
Fairmount Park Trans. Co.....	50	2,000,000	2,000,000	.....	14 1/2	...	*International Ocean Tel. Co. guar. 6 %	100	8,000,000	.....	1 % Q.	108	...
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2 1/2 % July 15, '97.	44	45	Mexican Telephone Co.....	100	2,000,000	.....	.....	60	70
Hestonville, Man. & Fairmount.....	50	538,900	538,900	8 % S.—July 15, '97.	61	65	*New York & New Jersey Tel. Co.	100	5,000,000	8,728,000	1 1/2 % Q. July, '97.	150 1/2	151
*Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '97.	63	66	*Pacific & Atlantic Tel. guar. 4 %	25	2,000,000	.....	2 % S.	71	76
Union Traction Co.....	50	80,000,000	5,986,095	.....	15 1/2	15 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 % Q.	...	...
*Electric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5 %	25	950,000	559,525	2 1/2 % S.	90	95
*Citizens' Passenger Ry.....	50	500,000	.....	.....	300	...	*Commercial Union Telegraph Co.....	25	500,000	500,000	8 % S. July 1, '97.	117	119
*Frankford & Southwark Pass. R.	50	1,000,000	1,875,000	\$14 share A.—Apr. 97	87 1/2	...	Western Union Telegraph Co.....	...	97,870,000	.....	1 1/2 % Oct. '97.	87 1/2	87 1/2
*Lehigh Avenue Ry.....	25	1,000,000	.....	.....	40	...	*Div. guar. by Postal Tel. Co.	...	.....	.....	...	...	...
*Lombard & South Street Ry.....	25	1,000,000	.....	.....	89	90 1/2	Miscellaneous.—Feb. 28:						
*Second & Third Streets Ry.....	50	1,000,000	.....	.....	260	...	American Dist. Tel. (Phila.).....	25	400,000	.....	.....	14	...
*People's Traction Co.....	50	10,000,000	600,000	3 % A., April, '97.	...	...	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2 % S.	174 1/2	175
*Germantown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1897.	132	...	Chesapeake & Potomac Tel. Co.....	100	.....	.....	.....	61	65
*Green & Coates Passenger Ry.....	50	500,000	150,000	3 % July, 1897.	132	...	Chicago Telephone Co.....	100	.....	.....	.....	202	...
*People's Passenger Ry.....	25	1,500,000	740,000	.....	...	...	Central Dist. Prtg. & Tel. Co. (Phg.)	100	750,000	750,000	.....	...	...
*People's Passenger Ry.....	25	750,000	277,402	.....	...	...	Empire & Bay States Telegraph Co.	100	.....	.....	.....	12	78
*Philadelphia Traction Co.....	50	30,000,000	120,000,000	4 % S.—Apr. 1, '97.	81 1/2	82	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1 % Q.	74 1/2	80
*Catherine & Bainbridge St.....	50	1,000,000	400,000	6 % A.—Mar. '97.	185	145	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2 % Q.	112	115
*Continental Pass. Ry.....	50	1,000,000	580,000	\$6 share—July, '97.	185	145	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	87 1/2	...
*Empire Passenger Ry. Co.....	50	600,000	600,000	.....	...	...	Southern New Eng. Teleph. Co.....	100	8,000,000	.....	.....	120	122
*Philadelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180							
*Philadelphia & Gray's Fy. RR.....	50	1,000,000	298,650	\$3.50 share July '97	87	...							
*Ridge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share July '97	262	...							
*Philadelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July '97.	...	...					
*17th & 19th Sts. Pass. Ry. guar.	50	.....	250,000	1 1/2 % S. July, '97.	157 1/2	...							
*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	835,000	\$11 sh. A., July, '97	263	...							
*Union Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. July '97	225	226							
*West Philadelphia Pass. Ry.....	50	750,000	175,000	\$10 share, July '97	225	235							
Rochester, N. Y.—Feb. 28:													
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16 1/2	18							
Reading, Pa.—Feb. 28:													
Reading Traction Co.....	...	1,000,000	1,000,000	Semi-an. Jan. & Jy	10	15							
*City Passenger Ry.....	50	850,000	850,000	July, '97.	111	...							
*East Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	80	...							
St. Louis Mo.—Feb. 28:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec. 1888.	...	...					
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 % July, '97.	124	126							
National Railway Co.....	...	2,500,000	2,479,000	1 1/2 % July, '97.	...	...					
Cass Avenue & Fair Grounds.....	...	2,500,000	2,500,000	.....	...	...				
Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct. '98.	90	110							
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 % July, '97.	95	105							
Missouri RR.....	50	2,400,000	2,300,000	1 1/2 % July, '97.	170	172 1/2							
People's RR. Co.....	50	1,000,000	800,000	50c., Dec. '89.	50	52 1/2							
Southern Electric Ry.....	50	500,000	500,000	.....	100	102 1/2							
Southern Electric Ry.....	100	1,000,000	1,000,000	3 % S. Jan. '96.	51	53							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	175	...							
Union Depot RR.....	100	4,000,000	4,000,000	3 % A., July, '95.	...	...					
San Francisco, Cal.—Feb.													
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	108	109							
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	53 1/2	...							
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	7	...							
Scranton, Pa.—Feb. 28:													
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	9 1/2	11							
*Scranton & Carbondale Trac. Co.	100	500,000	500,000	.....	15	18							
*Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11							
Springfield Ill.—Feb. 28													
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11							
Springfield O.—Feb. 28:													
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2							
Springfield, Mass.—Feb. 28:													
Springfield Street Ry.....	100	1,200,000	1,000,000	3 % A.	206	210							
Toronto Canada.—Feb. 28:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	98 1/2	99 1/2							
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	260 1/2	260 1/2							
Washington, D. C.—Feb. 28:													
Belt Ry. Co.....	50	500,000	500,000	.....	...	...				
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. '97.	70 1/2	70 1/2							
Columbia Ry. Co.....	50	400,000	400,000	5 1/2 % A.	68	70							
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	...	...				
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	...	...				
Metropolitan RR. Co.....	50	1,000,000	487,180	2 1/2 % Q.	121	...							
Worcester, Mass.—Feb. 28:													
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	17 1/2	18							
*Worcester Traction Co.....	100	2,000,000	2,000,000	3 % S. Sept. '97.	95	97							
*Worcester & Suburban Street Ry.....	100	550,000	542,500	4 %, 1896.	85	...							
Wilkesbarre, Pa.—Feb. 28:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 %, Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Leased to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1898-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10 % guaranteed by Reading Traction Company.
 n Dividend of 6 % guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ALLIED INDUSTRIES.

Boston Mass.—Feb. 28:													
American Electric Heating Co.....	50	10,000,000	.....	.....	...	...	Street Ry. & Ill'u'g Properties... pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	85	85
United Electric Securities Co... pfd.	100	.....	.....	.....	...	...				3 1/2 % Feb., '96.	80	85	
New York.—Feb. 28:													
Consolidated Electric Storage Co...	...	.....	.....	.....	...	...					7 1/2	88	94
Edison European.....	...	.....	.....	.....	...	...						15	20
Safety Car Heating & Lighting Co...	100	.....	.....	.....	...	...						89	90
Worthington Pump Co..... com.	100	5,500,000	5,500,000	.....	...	...				
Worthington Pump Co..... pfd	100	2,000,000	2,000,000	7 %									
Philadelphia, Pa.—Feb. 28 :													
Acetylene L. H. & P. Co..... \$35 pd.	50	1,000,000	.....	.....	...	...					5	...	...
Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	...	...					...	...	...
United Gas Improvement Co. scrip.	50	10,000,000	.....	.....	...	...					74 1/2	...	...
Welsbach Commercial Co..... com.	100	8,500,000	.....	.....	...	...					10 1/2	...	...
Welsbach Commercial Co..... pfd.	100	500,000	.....	.....	...	...					58	55	...
Welsbach Light Co.....	5	525,100	.....	.....	...	...					57 1/2	38	...
Welsbach Light Co., Canada.....	5	500,000	.....	.....	...	...					...	2	...
Pittsburg, Pa.—Feb. 28:													
Carborundum Mfg. Co.....	100	200,000	200,000	.....	...	...					101 1/2	102	...
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q									...
Miscellaneous.—Feb. 28:													
*Barney & Smith Car Co..... com.	100	.....	1,000,000	.....	...	...					15	18	...
*Barney & Smith Car Co..... pfd.	100	.....	2,500,000	2 %							69	73	...
Billings & Spencer Co.....	25	.....	.....	.....	...	...					88	41	...
Consol. Car Heating Co.....	100	1,250,000	1,250,000	3 1/2 % S. pas. Feb div.							35	37	...
Johns-Fratt Co.....	100	.....	.....	.....	...	...					...	102	...
*Pratt & Whitney Co..... com.	100	.....	.....	.....	...	...					10	14	...
*Pratt & Whitney Co..... pfd	100	.....	.....	.....	...	...					62	69	...
Stillwell-Eieree Co..... com.	...	.....	.....	.....	...	...					98	96	...
Stillwell-Eieree Co..... pfd.	...	.....	.....	.....	...	...					107	109	...
Shulls Belting Co.....	100	500,000	.....	.....	...	...					109	...	...
S. Charles Car Co.....	...	.....	.....	.....	...	...					85	90	...
* Unlis													

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.	NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.						Authorized.	Issued.				
Albany, N. Y.							New Orleans La.						
Date of Quotation—Feb. 28, 1898.							Date of Quotation—Feb. 21, 1898						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905				Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1890	J. & J.	*111	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....	Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	72½	.....
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....	New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1908	J. & D.	104	110
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	N. Or. City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
Troy City Railway Co. 1st 5s	.....	.....	.....	.....	*105½	106½	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	108	.....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.							Orleans Railroad Co. Cons. mtg. 6s. \$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$390,000 outstanding.						
Baltimore Md.							New York.						
Date of Quotation—Feb. 28, 1898.							Date of Quotation—Feb. 28, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	108	109½
Baltimore Trac. Co. Ext'n. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	108	107	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	.....
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	116	.....	Broadway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	112	.....	Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105½	108
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	112	.....	Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112
City & Suburban Ry. 1st mtg. g. 5.	3,000,000	3,000,000	1922	J. & D.	115	116	Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	.....
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	.....	Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	*107
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119½	121	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	115	116½
\$151,000 in escrow to retire 1st mtg. bds.							Brooklyn City & Newtown. 1st mtg. 5s. \$2,000,000 2,000,000 1939 J. & J. 114 116						
Boston, Mass.							Brooklyn Bath & W.E. RR. Gen. mtg. 5s. 1,000,000 448,000 1933 J. & J. 85 90						
Date of Quotation—Feb. 28, 1898.							Brooklyn Heights RR. 1st mtg. 5s. 250,000 250,000 1941 A. & O. 106						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	162	105	Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	107	.....
West End Street Ry. Deben. g. 5s.	3,300,000	3,000,000	1902	M. & N.	105	105½	Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	.....	108
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	.....	Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	94½	.....
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.							Bleeker St. & Fulton Ferry RR. 1st mtg. 7s. 700,000 700,000 1900 105 108						
Charleston, S. C.							Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s. 1,200,000 1,200,000 1902 J. & D. 113 115						
Date of Quotation—Feb. 28, 1898.							Central Cross-town RR. 1st mtg. 6s. 250,000 250,000 1922 M. & N. 118 122						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....	Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	800,000	1903	J. & J.	101	106
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....	D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	930,000	1932	J. & D.	115	117
Controlled by Charleston St. Ry. Co.							Dry Dock, E. Bd'y & Bat'y RR. scrip 5%. 1,100,000 1,100,000 1914 F. & A. 97 *101						
Chicago Ill.							Eighth Av. RR. Co. Cert. indebt. 6%. 1,000,000 1,000,000 1910 F. & A. 100						
Date of Quotation—Feb. 28, 1898.							42d St., Man. & St. Nich. Av. 1st mtg. 6s. 1,200,000 1,200,000 1910 M. & S. 116 118						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	103½	.....	42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....	Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....	Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1997	F. & A.	111½	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....	Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	.....	.....	Second Avenue Ry. Cons. mtg. 5s.	800,000	800,000	1909	J. & J.	101	105
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....	Second Avenue Ry. Deb. 5s.	300,000	800,000	1909	J. & J.	101	105
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	.....	55	Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	.....	52	South Ferry RR. Co. 1st mtg. 5s.	850,000	850,000	1919	.....	102	107
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	101½	.....	Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	128½	125
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	.....	108	Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....	Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103½	.....	Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	101½	105½	Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100½	101½	\$1,035,000 in escrow to retire gen. mtg. bonds. \$184,850,000 in escrow to retire maturing obligations. \$552,000 in escrow to retire 1st and 2d mtg. bonds. In treasury, \$80,000. Guar. by Union Ry. Co.						
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	94½	94½	Toronto Canada.						
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101½	101½	Date of Quotation—Feb. 28, 1898.						
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chl. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.							Montreal St. Ry. 1st mtg. 5s. 2,500,000 300,000 1908 M. & S.						
Cincinnati, O.							Toronto St. Ry. 1st mtg. g. 4½s. 4,550,000 2,200,000 1921 M. & S.						
Date of Quotation—Feb. 28, 1898.							\$35,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.						
Cin. New & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101	Philadelphia.						
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....	Date of Quotation—Feb. 28, 1898.						
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....	Continental Pass. Ry. 1st mtg. 6s. 350,000 310,000 1909 J. & J.						
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½	Empire Pass. Ry. 1st mtg. 7s. 300,000 200,000 1900 J. & J.						
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½	Greene & Coates St. Ry. 1st mtg. 6s. 100,000 100,000 1898 J. & J.						
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126½	.....	Lombard & So. St. Pass. Ry. 1st mtg. 6s. 150,000 1901						
Assumed by the Cincln. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.							People's Pass. Ry. 1st mtg. 7s. 250,000 250,000 1905 J. & J.						
Cleveland, O.							People's Pass. Ry. 2d mtg. 5s. 500,000 458,000 1911 J. & J.						
Date of Quotation—Feb. 28, 1898.							People's Pass. Ry. Cons. mtg. 5s. 1,125,000 367,000 1912 M. & S.						
aBrooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1908	M. & S.	105	106	People's Pass. Ry. Stk. trs. cert. g. 4s. 5,698,210 1943						
Cin. New & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101	Phila. City Passenger Ry. 1st mtg. 5s. 200,000 200,000 1910 J. & J.						
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	108	Philadelphia Trac. Co. Coll. tr. g. 4s. 1,300,000 1,018,000 1917 F. & A. 104 105						
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	105	Thirteenth & 15th St. Ry. 1st mtg. 7s. 100,000 100,000 1903 A. & O.						
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	.....	107½	Union Passenger Ry. 1st mtg. 5s. 500,000 500,000 1911 A. & O.						
aEast Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106½	107½	West End Passenger Ry. Coll. tr. 4½. 29,735,000 29,724,876 1945 A. & O.						
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	90	95	West Phila. Pass. Ry. 1st mtg. g. 7s. 250,000 246,000 1906 A. & O. 115½						
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	.....	1915	J. & J.	100	102	West Phila. Pass. Ry. 2d mtg. 5s. 750,000 750,000 1926 M. & N. 114½ 115						
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....	The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.							Pittsburg, Pa.						
Detroit, Mich.							Date of Quotation—Feb. 28, 1898.						
Date of Quotation—Feb. 28, 1898.							Birmingham, Knox & Allentown. 6s. 500,000 500,060 1931 M. & S.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,835,000	1905	A. & O.	.....	93	Central Traction Co. 1st mtg. 5s. 375,000 375,000 1930 J. & J.						
Fl. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	.....	Citizens' Traction Co. 1st mtg. 5s. 1,250,000 1,250,000 1927 A. & O. 115 116½						
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	93½	99½	Duquesne Traction Co. 1st mtg. 5s. 1,500,000 1,500,000 1930 J. & J. 110						
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.							*Fed'l St. & Pleas. Val. Jack's Run. 5s. 50,000 1913 J. & J.						
New Haven, Conn.							Fed'l St. & Pleasant Valley. Cons. 5s. 1,250,000 1,250,000 1942 J. & J.						
Date of Quotation—Feb. 28, 1898.							Millvale, Etna & Sharpsburg. 5s. 750,000 750,000 1923 M. & N. 708½						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	104	.....	Pittsburg, Crafton & Mansfield. 5s. 250,000 250,000 1924 J. & J. 105½						
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....	Pittsburg Traction Co. 1st mtg. 5s. 750,000						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Feb. 28, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1906	M. & N.	101	108
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	104½	107½
Missouri RR. Co.....1st mtg. 5s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 5s.	500,000	500,000	1918	J. & J.	111	112
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Feb., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	.....
Geary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 5s.	8,000,000	8,000,000	1918	J. & J.	128	129½
†Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omni-bus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	109½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
†Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Feb. 28, 1898.						
Belt Ry. Co.....C.....mtg 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....mtg. 6s.	500,000	500,000	1914	A. & O.	120	.....
Eckington & Soldiers' Home.....mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Feb. 28, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	110
Citizens' St. R. (Ind. polis) 1st cons. mtg. 5s.	4,000,000	8,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st mtg. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95½	98
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	103
†Crosstown St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	95	98
Denver City Cable Ry. 1st mtg. g. 5s.	4,000,000	8,800,000	1920	J. & J.	98	97
Denver Con. Tram'y Co.....Con. mt. g. 5s.	4,000,000	922,000	1933	A. & O.	98	97
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	113	113½
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	92	94
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.).....Deb. 6s.	500,000	489,000	1902	F. & A.	118	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	*95	99
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$820,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Feb. 28, 1898.						
Edison Elec. Illuminating Co., Boston.....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s....	10,000,000	8,750,000	1922	.....	101 1/2	.....
Pittsburg, Pa.						
Date of Quotation—Feb. 28, 1898.						
Allegheny County Light Co.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light.....	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous.—(Feb. 28, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s....	4,312,000	4,312,000	1910	.....	111 1/2	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,160,000	1993	.....	116	.....
Edison Elec. Ilig. Co. (Brooklyn) g. 5s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia).....	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.).....	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Feb. 28, 1898.						
American Bell Telephone.....	7s.	.....	1898	F. & A.	100 1/2	104
Northwestern Telephone.....	7s.	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	103 1/2	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Feb. 28, 1898.						
American Electric Heating.....	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. ....	.....	.....	.....	.....	.....	25
*Berney & Smith Car Co. ....	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. ....	.....	.....	1904	M. & S.	.....	.....
Washington Pump Co.	75,000	.....	.....	.....	.....	.....
*Unlisted	.....	.....	.....	.....	.....	.....
†Nominal.	.....	.....	.....	.....	.....	.....

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 10 3/4 @ 10 1/2 c.; Lake, 11 1/2 c.; cast, 10 1/2 @ 11 c.

The New Orleans Traction Company continues to show a good increase of earnings over last year. For the first ten days of February the gross receipts were \$34,090.75, against \$32,598.95 for the same period last year.

The hearing on the motion for the appointment of a receiver for the Little Consolidated, Cleveland, O., on petition of Frank De H. Robison, was concluded after arguments lasting three days. The decision was reserved.

The Edison Electric Illuminating Company of Brooklyn reports for January: Gross earnings, \$59,381; operating expenses, \$45,379; net earnings, \$14,002. The balance for dividend was \$35,352, an increase over the same month in 1896 of \$522.

Storage battery cars are being tried on the Grand street car line in New York, and cars thus equipped have made several successful trips over the road. The new cars are about as long as the Third Avenue cable cars and are lighted by electricity.

The shareholders of the Coney Island & Brooklyn Railroad have voted to increase the capital stock of \$1,000,000 to \$2,000,000. The increase, it is understood, is preparatory to complete consolidation with the Brooklyn City & Newtown Railroad, now held under lease.

The stockholders of the Milwaukee Electric Railway & Lighting Company held the annual meeting on the 21st ult., but it was little better than a formality, little being done beside the re-election of F. G. Bigelow of Milwaukee and William Nelson Cromwell of New York as directors.

The Boston Elevated Railroad Company has petitioned the Railroad Commissioners for permission to extend its tracks from the Cambridge line to the town of Belmont. The "Traveller" says the third-rail system has been decided upon for the elevated structure, with trolley propulsion for the underground. Trains will consist of three cars and a motor car.

The directors of the St. Louis & Belleville Electric Railway Company have published a notice calling a meeting of the stockholders at the office in East St. Louis on the 15th of April for the purpose of voting on the proposition of issuing bonds of said company to the amount of \$500,000, the same to be secured by a mortgage on all of the property of the company.

The Twin City Rapid Transit Company of Minneapolis has listed on the New York Stock Exchange an additional \$577,000 of 7 per cent. preferred stock, making total listed \$1,712,000. The proceeds of the new stock and of a new issue of three-year 6 per cent. notes for \$750,000 have been applied to the redemption of the \$1,435,000 6 per cent. guaranteed certificates issued in 1893.

The report of the Metropolitan Street Railway of New York City for the quarter ending December 31 last has been filed with the State Railroad Commission. It shows a net increase in earnings as compared with the corresponding quarter of 1896 of \$118,484. The report shows: Gross earnings, \$2,383,458; operating expenses, \$1,208,769; net from operation, \$1,174,688; other income, \$150,918; gross income, \$1,325,607; fixed charges, \$789,000; surplus income, \$536,600. The surplus income for the same quarter in 1896 was \$418,116. The general balance sheet shows cash on hand of \$1,163,807, and a profit and loss (surplus) of \$1,737,198.

Some of the street railway companies in Massachusetts have discovered a way of evading the law in regard to the issue of securities by issuing what they call "coupon notes" instead of bonds. One of these is the North Shore Traction Company, a corporation chartered in New Jersey, which in 1896 got possession of the three mile Beverly & Danvers street railway, capitalized for \$12,000. It issued \$40,000 of coupon notes, and before a bill to prevent such transactions could be passed through the Legislature it had sold \$1,250,000 of such notes, and it now has a capital of \$1,200,000 and a funded debt of \$1,629,000. The Railroad Commissioners have severely rebuked such transactions, and in the case of the Interstate Consolidated Company have thrown \$150,000 of coupon notes out of its assets; and they protest against the admission of any more foreign corporations to operate railways in the State unless also incorporated under Massachusetts laws.

Contracts have been closed with electric companies by the Brooklyn Elevated Railroad Company for the fitting of its cars and tracks with the necessary equipments to cross the Brooklyn Bridge. The equipment includes twenty-four new motor cars of the Sprague multiple unit pattern. The company intends to put the electric system in use on all of its cars and do away with the engines as soon as it is practicable that this should be done. It is believed that the crush during the rush hours at the Manhattan end of the bridge will be greatly relieved by the crossing of the elevated cars.

The Assembly committee at Albany has given several hearings to the opponents of the Sullivan bill fixing the price per hour for incandescent lights at three quarters of a cent and for arc lights at 4 cents. A representative of the Edison Electric Light Company told the committee that there was no demand for the measure from anyone but the Sullivans in House and Senate. He said the man who introduced the bill didn't know the prices now charged, and showed that the average present prices are lower than the prices fixed in the bill.

The New York "Journal" says: "Russell Sage has been investigating the Sprague motors with the idea that they could be used to advantage in the Manhattan Company's system. The Goulds and other large holders of Manhattan stock approve of them, and are only holding off to see the result of the Brooklyn company's experiment. It has been decided by the Manhattan Company that the Sprague motors are much better than the third rail system and the air motors."

The Cleveland "Plaindealer" says: "The recent activity in the stock of the Big Consolidated is said by a gentleman well informed in financial circles to be due to the intimation by an Eastern banking house that in case they could secure a controlling interest in the company they would be willing to pay as high as \$65 per share for stock, if forced to do so. This is said to be due to their faith in their ability to refund the bonds of the corporation at 4 per cent., these obligations now drawing 5 and 6 per cent."

The Railroad Commissioners of Massachusetts in their annual report have rendered a service to all interested in street railway management by showing where mistakes have been made and suggesting remedies to place the business on as stable a footing as that attained by any well established and conservative institution. They also give some hints to investors that it would be safe for them to heed in the following passage: "An intending investor in an existing or projected street railway enterprise will take into account the chances in a series of years of a management and success a little below as well as above the general average. If he desires a regular annual return of 6 per cent. on his shares, he ought to be convinced, we think, that the railway will carry year in and year out more than 135,616 passengers per mile operated, and more than 4,014 per \$1,000 of capital investment; otherwise, the probabilities, based on the experience of 48 companies, are that he must be content with a smaller return. Unless it can be demonstrated, moreover, that the railway will carry year in and year out more than 70,895 passengers per mile operated, and more than 2,532 passengers per \$1,000 of capital investment, the chances, as proved by the experience of 28 companies, are that he will receive no dividend at all. There is in fact a very narrow range of speculative possibility in street railway investment. The results are practically uniform from year to year, and grade on substantially the same levels with those of railroad enterprise. A certain density of traffic in proportion to mileage operated and to capital investment per mile, is absolutely essential to financial success, and is the substantial measure of such success."

ELECTRICITY.

Vol. XIV.

NEW YORK, MARCH 9, 1898.

No. 9.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, -- 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUMS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	vi
Classified List of Advertisements,	viii
Editorial Notes,	129-130
Low Cost of Steam Power in Buffalo.	
Technical Education.	
A Telephone Bill in Albany.	
Under the Searchlight,	130
How He Satisfied the Brewer.	
The Resistance of Silicon,	131
Electrical Engineering at Columbia University,	131
A Survey of the Possibilities of Electric Heating and Cooking. By W. P. Adams, A. I. E. E. (Concluded),	133
An Electrolytic Process for the Manufacture of Parabolic Reflectors. By Sherard Cowper-Coles. (Concluded),	134
The Electrical Equipment of the Maine,	135
Roentgen-Ray Work in English Hospitals,	136
Standard System of Electrical Diagrams,	136
A Special Prize Offer,	137
Proposals Invited,	137
The Telegraphic Tournament,	137
Legal Notes,	137
The News,	137
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Recent Company Elections,	139
Commercial Paragraphs,	139
Incorporations,	139
Electrical Patent Record,	139
Telephone and Telegraph,	140
Electrical Securities—Stocks, Bonds, Etc.,	141
Notes for Investors,	144

EDITORIAL NOTES.

Low Cost of Steam Power in Buffalo.

From all accounts it is taking considerable missionary work to convince the manufacturers located in Buffalo that it would be more economical for them to adopt electricity furnished by the Cataract Power and Conduit Company than to continue using steam for the running of machinery.

As a result of this conservative feeling, and owing to the fact that the manufacturers could not clearly see where any material saving would be effected by substituting electricity for steam, the Cataract Company a short time ago retained an electrical engineer to examine various plants and make estimates of the comparative cost of steam and electric power. This has been done, and it is now stated that, according to the engineer's figures, a number of plants would derive benefit by the adoption of electricity. This may very possibly be the case in the manufacture of certain products that require a large and constant amount of power during 24 hours a day and for 365 days in the year, for in all probability the Cataract Company's expert has figured on prices which are quoted on maximum power. In most industrial operations, however, the demand for power is extremely variable, and in such cases a manufacturer would be paying for considerably more power than he was actually using.

As we stated in an editorial some time ago, when the Niagara Falls Power Company had just started, it is extremely difficult to see how under the existing conditions current can be delivered to Buffalo, a distance of nearly 26 miles, and be made to successfully compete with steam in any way but at a loss to the producer.

Electricity has in a number of instances been generated by means of water power transmitted over long distances, and proven more economical than steam, but invariably in such cases the local price of fuel was extremely high. An example of such a plant is that of Pomona, Cal., where current is transmitted over a distance of 28½ miles to San Bernardino at a pressure of 10,000 volts and is used for arc and incandescent lighting. In this instance it was found more economical to bring current 28½ miles than to erect a local power station to be operated by steam.

In the case of Buffalo, however, the conditions are very different. An excellent quality of coal can be procured in that city for \$1.80 a ton, or in other words, steam power can be generated for about one-third of a cent per horse-power hour. This figure does not of course include the item of labor and other incidental expenses, which however would probably not exceed twice the above amount, making the total cost of one horse-power hour one cent. To success-

fully compete with steam as a motive power, therefore, the Niagara company would be obliged to deliver one electrical horse-power at a motor in Buffalo for an amount not exceeding two-thirds of a cent. Whether this could be done and still leave a modest margin of profit to the producer is questionable. Another important point which should not be overlooked by the Buffalo manufacturer is the cost of changing their machinery if electricity as a motive power is adopted. There would have to be a decided saving due to the adoption of electricity to warrant an expenditure of probably thousands of dollars which such a change would entail. Taking it all in all, the Buffalo manufacturers cannot be blamed for showing a conservative spirit in this proposed innovation.

* * *

Technical Education.

The problem of striking a happy medium between a too theoretical education and a too practical education is an all-important one. This vital question is constantly being agitated both in Europe and in this country with apparently indefinite results. A thorough theoretical education is unquestionably an advantage to an engineer, but on the other hand, experience has shown that a student thus equipped on leaving a technical school is seriously handicapped until his ideas have become broadened by practical experience. In fact we have known of cases where manufacturing concerns have declined to employ recent engineering graduates, on the ground that it would require too much time to teach them the practical side of the business and that during that period their services would be of little or no value. This feeling on the part of manufacturing concerns arises from the knowledge that in most technical schools the student acquires long-drawn-out methods of arriving at mathematical results and has had little or no opportunity of learning anything of a practical nature. With a view to offsetting this theoretical tendency, several of the larger manufacturers of electrical machinery in this country require recent graduates who apply to them for positions to go through a certain amount of practical training in their shops, extending over a period of several years, at nominal wages before giving them anything like a reasonable salary or entrusting them with work of a serious nature.

Probably the hottest of theoretical training is however in Germany. In the latter country an embryo engineer is simply saturated, so to speak, with the higher mathematics for years before being allowed to graduate. This system, although favoring strongly of the methods in vogue during the Middle Ages, has however been the means of giving to the world invaluable theories and discoveries, through eminent scientists such as Helmholtz, Hertz, and others. Prof. Adolf Slaby, one of Germany's

highest authorities on electrotechnics, is credited in a recent issue of a daily paper with the following :

"Practical teaching is abhorred by the professors at most of our universities. I recollect attending a lecture by Helmholtz where I expected him to give some explanation of the dynamo. After making some theoretical observations, he merely said : 'Acting on these principles people have constructed some very ingenious machines called dynamos, for engineering purposes.' That was all Helmholtz would deign to say about the dynamo. The professors of to-day are just the same in this respect. Their teaching is purely scientific, philosophical, philological and historical and has not varied for three centuries."

The above statement, coming as it does from one of Germany's leading professors, is significant. It would unquestionably be a difficult matter to properly combine a theoretical and practical course in a university. If the theoretical training were thorough, there would necessarily in a four years' course be little time left to devote to the practical training, or vice versa. It scarcely seems right, however, that a student after graduating should be obliged to devote several years at little or no salary to modifying the ideas that were inculcated in him while at a university.

In Germany there are nine technical schools, the largest being at Charlottenburg, near Berlin. Others are located at Stuttgart, Hanover, Munich, Dresden, Aix-la-Chapelle, Karlsruhe, Darmstadt and Brunswick. As a rule these schools are divided into six departments, as follows : Architecture, general constructing engineering, machine construction, naval engineering, chemistry and mining engineering. Electrotechnics are taught in all the schools in the machine construction department, it being thought advisable and necessary that every constructing engineer should be thoroughly familiar with electrical machinery.

Many suppose that Germany, being a country of universities, the curricula of its technical schools have been overhauled and brought up to date, but such is not the case. Pure science would seem to be the principal aim of all these schools, the turning of the laboratory results thus obtained to practical account being despised by the majority of the university professors. This same tendency exists in this country, but to a lesser extent. An electrical engineer to be in any way successful in the United States should be, above all, practical, and when such a quality is combined with a high degree of theoretical knowledge, an engineer is exceedingly well-equipped for any duty he may be called upon to perform. Several of our technical schools have gradually been brought to see the value of combining a theoretical with a practical education, and have even gone to the extent of equipping shops with suitable machinery for the use of students. Such a step is to be commended, for even the limited knowledge a student obtains in this way proves of inestimable value after leaving his alma mater and entering into practical work. As Prof. W. E. Ayrton aptly stated in an address at the Coventry Technical Institute in England : "The ideal technical school would be one attached to a factory where the men could be systematically taught their business and the applications of science to their trade."

* * *

A Telephone Bill at Albany.

A telephone bill has recently been introduced in the New York Legislature by Senator Brush, providing for cheaper telephone rates as follows : In cities of 1,000,000 inhabitants and over, \$125; in cities less than 1,000,000 and more than 500,000, \$85; less than 500,000 and more than 100,000, \$48; less than 100,000 and more than 20,000, \$36; less than 20,000 and more than 8,000, \$30; places less than 8,000, \$27.

The introducing of a bill of the above character is

certainly a step in the right direction, for the charges of the New York Telephone Company in New York City are higher than the rates in any other city in the world. The arguments that Senator Brush brought up at a recent hearing before the Senate Finance Committee in support of his bill are exceedingly strong, and moreover give a good idea of how the public has been victimized for years by a monopoly without being able to obtain redress in any way. Some of the reasons Senator Brush gave why the bill should be passed are exceedingly instructive, the gist of them being as follows :

"The company has an absolute monopoly in New York and many other cities in this State.

"There is no competition to regulate charges and no limitation by statute.

"Taking advantage of this situation in New York, the company has by stages advanced the charge from \$60 a year in 1881 to \$240 in 1897.

"There is nothing to prevent similar advances in the future, if the company think the people can be made to pay them.

"The telephone has become a necessity, and as such, controlled by a monopoly, the charges should be regulated in the public interest.

"The rate in New York is higher than anywhere in the world for the same service.

"In six years, ending with 1887, the Metropolitan Company made a profit of 473 91-100 per cent. on its original investment of \$600,000. These figures were shown by testimony taken by the Ainsworth Investigating Committee. Such excessive profits made by a monopoly serving the public under a public franchise demand the interference of the police power of the State in the public interest.

"The companies use the public streets and highways, and the State should require that, in return for such privileges, the public, which confers the franchises, should not be unreasonably taxed for the service. The Ainsworth Investigating Committee of the Assembly, after a careful examination, recommended a bill which fixed the charge in New York at \$6.50 a month, or \$78 a year, within one mile of a central office. The rate then charged was \$150 a year, or nearly 100 per cent. higher than the Ainsworth Committee thought fully remunerative. All items of facts obtained by the Ainsworth Committee in 1887 were under oath.

"The capital of the Metropolitan Company in January, 1897, was \$3,300,000; that was the amount upon which the State tax was paid. There had been no increase for several years. Its earnings were : Year ending September 30, 1894, \$2,182,454; year ending September 30, 1895, \$2,419,194; year ending September 30, 1896, \$2,800,000. This shows an increase of earnings in two years, between 1894 and 1896, of \$617,546 on the same capital."

From all accounts the gross earnings of the New York Telephone Company should now be in the neighborhood of \$3,000,000 a year, as they claim they have a total of about 25,000 subscribers, 5,000 of whom pay \$240 a year and the remainder \$90. Allowing that the operating expenses of this company is one-half of its gross receipts, or \$1,500,000, there would be a clear profit of almost 50 per cent. on its present capitalization. The following abstract from Senator Brush's argument will give some idea of the actual cost of furnishing telephone service :

"In 1894 the Interior Department at Washington paid the Bell Telephone Company from \$60 to \$125 each for sixty-one telephones, which, together with the salary of the operator at the central station, aggregated \$4,883, being an average of a fraction over \$75 per annum per instrument. The next year, 1895, the Department put in a telephone system of its own, consisting of 140 lines connecting extra buildings in the city. They were attended by the same operator at the same salary as formerly, and, in addition to this, an electrician was employed to keep the lines in order at an expense of \$300 per year. Estimating the interest and depreciation of the

plant, the cost for each telephone is now \$10.75 per year, a saving of over \$64.25 on each instrument in use. In other words, the Department of the Interior performs for itself the same service at one-seventh the price formerly charged by the Bell Company for the same thing."

If the actual cost of rendering telephone service is but one-seventh of what the Bell Company is in the habit of charging, the expense that the New York Telephone Company is under, assuming all its 'phones are charged for at the rate of \$240 a year, is therefore but about \$857,500; or in other words, with the gross receipts aggregating \$3,000,000, they are making 65 per cent. clear on the capital invested.

From this it will readily be seen that it is high time that some measure was passed at Albany cutting this company's profits down to within a reasonable limit, and we trust therefore Senator Brush's bill will pass.

Under the Searchlight.

Notes and Comments on Various Topics.

FROM all accounts the Westinghouse Electric & Manufacturing Company are certainly going in for the gruesome. A short time ago this company made a contract for lighting a number of the catacombs in Rome, and now negotiations are said to be on with this same concern for lighting the interior of the Pyramids of Egypt. Probably the next thing this company will be after will be the lighting of the abandoned stone quarries under Paris which were used as a charnel house during the Revolution.

Keep it up, George, you are something of an adept at underground work, and having discovered a field where you are not likely to encounter competition, you may work it with more profit than you have found in undertakings nearer home.

* * *

"A standing reward," says the *Morning Telegraph*, "is offered in Wall Street for positive proof that Manager I. Harding of the Walker Electric Company is not bald-headed. It is not expected that any one will come forward to claim the reward, for no one ever saw Mr. Harding without his hat on. He always wears a very tall and very shiny silk hat, and he always wears it. In the office or out the Harding hat is kept on the Harding head. Some of the Walker Company's rivals would like to see the hat removed in order to satisfy themselves that it does not conceal some patent electrical appliance for galvanizing customers into signing contracts. The Walker Company has been securing so many of the contracts recently that the rivals are getting worried about it. Their hats are off to the Walker Company. There can be no doubt about that since the Walkers walked off with the contract for electrically-equipping the Brooklyn 'L' roads, leaving an aggregation of weeping directors at the offices of the General Electric and Westinghouse companies to mourn its loss."

* * *

A floating paragraph states that electrical workers are just now in great demand at the Brooklyn Navy Yard. The naval officials are said to be engaging all the available electricians in the immediate vicinity and sending them to various navy yards and ships where they are required.

* * *

FROM the following paragraph, which appeared in the last issue of the *Electrical Engineer* of London, it would seem as though the people of Great Britain were beginning to worry over the amount of electrical apparatus that has of late years been imported into that country : "According to a recently-issued official document, the United States sent to this country last year electrical apparatus of one kind or another to the value of nearly £88,000. When we add to this amount that of apparatus obtained from the Continent, we begin to ask what are

our factories doing? There is one thing they seem not to be doing, and that is making good profits. The share quotations are not particularly favorable. One thing we venture to prophesy, and that is the present craze for monophasic alternate current installations is doomed. Our commercial travelers are simply ages behind the times as things go elsewhere, and deserve to be kicked out of the market. Naturally, they are so kicked."

* * *

ACCORDING to one of the daily papers, electricity and spiritualism do not make a good combination. A medium who makes a specialty of luminous apparitions is said to have given a seance recently at the house of a scientific man and successfully reproduced from his recess in a darkened room the luminous visions of various deceased personages. While Shakespeare was on view, the awe-stricken audience was surprised to hear a gasping, gurgling noise proceed from his throat, while the head swayed to and fro as if in pain. A gentleman rushed forward just in time to save the great poet from suffocation by pulling out of his thorax a miniature electric lamp, connected by a slender wire to a small battery underneath his coat. On the principle of the school-boy's salamander trick of illuminating the face by putting a lighted match in the mouth, the medium caused a faint spiritualistic glow, enough to satisfy wonder-seekers, to suffuse his countenance by inserting, before his hands were tied to insure confidence, the tiny electric lamp behind his teeth. Unfortunately in this case the article slipped too far down, and as the medium's bound hands prevented him pulling it up again the unfortunate man came very near being choked to death by an incandescent lamp.

* * *

How He Satisfied the Brewer.

We find the following amusing tale in *The Telephone*:

J. G. Nolen, who is an oldtimer in the electrical construction business, tells a good story on "Val" Blatz, the millionaire brewer of Milwaukee.

Mr. Nolen says: "Our company had had some correspondence with Mr. Blatz regarding the putting in of a telephone plant in his big brewing establishment, and I was sent up to try to close a deal.

"I took a couple of our 'phones with me in order to make a practical demonstration, should one be required, and I went with the intention of making a sale.

"I got to talking with Mr. Blatz and showed him the advantages of putting in our inter-communicative system throughout his establishment. He listened attentively, and finally said:

"Yes, that is all so; very true. But," and he spoke with the conviction of one who was putting a poser, "but my men down in the malt-house and the warehouses and cold-storage are all Dutchmen.

"I, myself, though a German, and a graduate of the universities of Leipzig and Heidelberg, can speak English, but what good would your telephones be to my Dutch workmen, who cannot talk English at all?"

"Well, I saw how the land lay. Old 'Val' could not get it through his head that the telephone would transmit anything but the language of America. I was bound to make the deal, as I said before, so I remarked to Mr. Blatz:

"I can put on some German receivers if you so desire. I have some with me."

"I connected up the 'phones, made a show of changing the receivers, and in half an hour Mr. Blatz was talking to one of his 'Dutchmen' down in the malt-house. He was delighted.

"You may put them in," he said, "and I shall want one German one in the malt-house, one German one in each warehouse, English ones in my office and the business office, and a German one in the cold-storage house."

"We closed the deal, and Mr. Blatz was glad to pay \$2 extra for each 'German annunciator' we put in. When the 'phones were shipped from the factory I had them labelled German and English respectively, and the big brewer was perfectly satisfied.

"It was five years before I saw Blatz again," concluded Mr. Nolen. "He recognized me at once, and said, with a hearty German laugh, 'You are the accommodating gentleman who put in the German and English telephones for me. Well, you are a good one.'"

The Resistance of Silicon.

In a communication to the Academie des Sciences, M. Fernand Le Roy gives the results of some tests

he has made on the electrical resistance of silicon. In view of its high specific resistance M. Le Roy suggests that this non-metal should prove of service for electric heating. Another advantage of silicon for this purpose would be its high specific heat and great emissive power. In the experiments the best results were obtained with the crystallized silicon or graphitoid, originally obtained by M. Sainte-Claire Deville. During the experiments, which have been continued for nearly three years, M. Le Roy has not yet been able to determine the exact specific resistance of the material, as he finds that it varies greatly with the state of pulverization, the compression and with its preparation. It is, however, easy to obtain rods of pure agglomerated silicon of a sectional area of 40 sq. mm. and a length of 10 cm., which have a resistance of from 25 to 200 ohms. The resistance of a rod of electric light carbon of these dimensions would be 0.15 ohm, and that of a rod of german silver of the same size 0.0008 ohm. The experimenter also found a decrease in resistance with increase of temperature. When such a rod was raised to 800° C. its resistance decreased about 40 per cent.

ELECTRICAL ENGINEERING AT COLUMBIA UNIVERSITY.

The new buildings of Columbia University are located at 116th street between the Boulevard and Amsterdam avenue, New York, on the highest part of Morningside Heights, midway between Grant's Tomb and the new Episcopal Cathedral, commanding a view of the Hudson on the west and the Harlem River on the east. Thus situated in a great metropolis, the University secures the manifold advantages which that fact gives it, and at the same time is sufficiently lifted above the hurry and noise of the city to have the collegiate atmosphere. This effect is still further increased by the fact that the grounds between the various buildings form a plateau about twenty feet above the level of the grounds and streets outside of the group of buildings. By this arrangement great economy of space is secured, since it gives two more floors to each of the buildings situated around the edge of the plateau, their basements and sub-basements being above the level of the surrounding grounds. The raised level between the buildings also enables tunnels to be constructed which connect the various buildings with the central power plant in the University Building. Through these tunnels all the steam and gas pipes as well as the electrical conductors are carried and the cartage of coal, ashes and supplies takes place.

In this way these important practical matters are very conveniently carried on below ground as far as the college is concerned, but at the same time above the street level. Each building is provided with an elevator, chiefly used for carrying apparatus and supplies to and from the various laboratories, lecture rooms and museums. Thus it is an easy matter to transport even heavy apparatus from any room in the University to any other room. To still further facilitate this service, the door sills are entirely omitted in most of the rooms, so that a truck can be run about the buildings without jarring that which it carries, enabling apparatus to be arranged in the laboratory for use in the lecture rooms.

The various buildings at the new site are grouped about the magnificent Library presented by President Low which is centrally located and easily accessible from all the others.

University Hall is the other general building, containing the power plant, gymnasium, academic theater, etc. There are also four new buildings respectively devoted to engineering, chemistry, natural science and physics. Two old buildings will be used for the present by the departments of Ancient and Modern Languages and Mathematics.

The Schools of Law, Political Science and Philosophy are located in the Library Building, bringing

them within convenient reach of the books upon which they are especially dependent. The Medical School will remain at Fifty-ninth street, between Ninth and Tenth avenues, where it is well provided with buildings and equipment. All the other departments of the University, including Barnard College and the Teachers' College which are affiliated with it, have removed to the new site.

The Engineering Building, with its annex, contains the departments of Electrical, Mechanical, Civil and Mining Engineering. Havemeyer Hall, the Chemistry Building, is the home of one of the largest and best equipped chemical schools in the world, having been designed by Prof. Charles F. Chandler and the officers of his department after a careful study of the principal colleges and technical schools in this country and abroad. The department of Architecture is temporarily housed in the Chemistry Building, which has more than sufficient space for present needs. Sohermerborn Hall, the Natural Science Building, contains the departments of Geology, Mineralogy, Biology, etc., and their extensive collections. The Physics Building, which also accommodates the departments of Mechanics and Astronomy, is designed and equipped according to the most modern methods for teaching and investigating physical science.

It is a striking fact, characteristic of modern tendencies, that all four of the new buildings, besides the Library and University Buildings, which are used for general purposes, are devoted entirely to science; and three of them are especially important in their relation to electrical engineering. Hence the course in Electrical Engineering at Columbia, which has already gained for itself a prominent position in electrical education in this country, has been materially benefited by the removal of the University to its new site. The principal improvements consist in a considerable extension of space and equipment in the Electrical Engineering laboratories, as well as in those devoted to Mechanical Engineering, Physics and Chemistry.

The regular four years' course, leading to the degree of Electrical Engineer (E. E.), is designed for the education of professional electrical engineers who intend to devote themselves to the practice of this profession either as teachers in colleges and scientific schools or as engineers, managers or experts in manufacturing or other industrial enterprises.

The course of instruction includes not only all important branches of theoretical and applied electricity, but also the other collateral sciences which have been found by experience to be required by the electrical engineer, such as mathematics, physics, chemistry, drawing, analytical mechanics, mechanical engineering, including a thorough course in steam and other engines, as well as transmissive machinery and shopwork; general engineering, including construction in masonry, iron, steel and wood, also forms part of the course.

Hence the graduate in the course in electrical engineering is provided not only with a thorough knowledge of the principles and practice of electricity, but also with such a broad and liberal education in the allied sciences as will prepare him for every demand that is likely to be made upon him in after life in connection with his profession, and will also enable him to become an investigator. The instruction is by lecture, recitation, laboratory, workshop and drawing-room practice, with periodical examinations. Special attention is given to new methods and forms of apparatus in order that the student may be brought fully abreast of the rapid progress of electrical science and practice. Frequent visits are made to the numerous electrical factories, stations and other establishments in and about New York.

EQUIPMENT.

The offices, laboratories, lecture and other rooms of the Electrical Engineering department are in the south end of the Engineering Building. In the sub-basement are located the storage battery and pho-

tometer rooms; the former contains a battery of 70 cells, to be used for efficiency and output tests and also as a source of steady potential and current. The photometer room is equipped with all necessary apparatus for determining the candle power of arc and incandescent lamps as well as other sources of light. In the basement are situated the two machine laboratories, the larger containing the direct current machinery, while the smaller accommodates the alternating current apparatus. In the former, a 50 HP. high speed steam engine drives two lines of shafting, carrying pulleys controlled by friction clutches, to which the various machines are belted. The arrangement of the engine and shaft is such that two dynamos of 30 kilowatts each can be connected to the engine, or either or both of the two machines may be used as motors to drive the line shaft, the current being obtained from the electric light and power plant of the University. In this way the breaking down of the motive power is rendered almost impossible and an excellent demonstration of the two methods of driving is made.

The various dynamos which are belted to the line shaft include examples of 115, 230 and 500 volt constant potential generators, constant current arc-lighting dynamos, and other typical machines. Several types of stationary and railway motors as well as motor dynamos are also placed in this room. Machine and hand tools are provided in one corner of this laboratory for making and repairing apparatus, attachments, etc. Complete sets of ampere and volt meters, speed indicators, transmission and absorption dynamometers, etc., are available for testing the various dynamos and motors. The smaller machines are mounted upon two long, heavy tables, which brings them to a convenient height and affords space for instruments, note books, etc.

In the other machinery laboratory, the alternating current apparatus is placed, including single and polyphase generators, induction and synchronous motors, as well as various types and sizes of transformers. Each generator is driven by its own electric motor, enabling its speed to be independently regulated.

On the first floor are situated the smaller lecture room (seating 70), ordinarily used for class work, and the larger lecture room (seating 150) for combined classes. In the Chemical Building, immediately adjoining, a still larger lecture room (seating 350) is available for meetings and public lectures. All of these rooms are provided with an ample supply of electrical energy of different forms, as well as gas, water, and other facilities to enable experimental demonstrations to be conveniently and effectively performed. For example, dynamos, motors and other apparatus of practical size are shown in actual operation to illustrate the lectures, this being made a special feature of the instruction.

The museum contains cases for the collection of apparatus, models, materials, etc., relating to electrical engineering. This museum adjoins the lecture rooms so that its contents can be conveniently used for illustration.

On the third floor are located the large instrumental laboratory, the research room, and the studies of the officers. The laboratory contains a number of tables on which the instruments are permanently set up ready for use. These include various forms of galvanometers, ampere balances, standard cells and resistances; apparatus for measuring inductance, magnetic permeability, hysteresis and leakage, laboratory standard volt and ampere meters; telegraph, telephone and electric signaling systems; thermo-electric and electrical heating devices; Roentgen ray apparatus. The research room is used for special postgraduate and thesis work, and is fitted up according to the lines of investigation that are being followed.

A most important facility is the large and reliable supply of electrical current which is afforded by the central power plant of the University. This consists of boilers having an aggregate capacity of 2,000 HP.,

two low-speed engines directly connected to two dynamos of 275 HP. each, and two high-speed engines directly connected to two dynamos of 100 HP. each. This electrical generating plant, having a total capacity of 750 HP., and illustrating the latest practice in electrical engineering, furnishes current for electric lighting and for driving the motors and fans used in ventilating all of the buildings. Special conductors are also laid to convey to all the laboratories as well as lecture rooms of the Electrical Engineering department an ample supply of current for experimental work.

The physical laboratories and lecture rooms occupy four floors of the Physics Building on the eastern side of the University grounds. The building is supplied with all ordinary conveniences, including electricity for power and light, compressed air and steam. There is a vertical shaft 95 feet high with gas, electric and water outlets at every ten feet. In the sub-basement a constant temperature room is placed 12 feet below the surface of the ground. A platform on the roof is available for meteorological observations, an instrument room being directly below. There are two lecture rooms, a library, an apparatus room, and laboratories of various kinds.

The general elementary laboratory includes in its equipment, linear and circular dividing engines of various designs. For measurements of mass there are provided balances with weights, specific gravity apparatus, hydrometers, aerometers and the various forms of vapor-density apparatus. Standard barometers, pendulums, and apparatus for studying elasticity are provided, also apparatus for the study of sound.

Thermometers and apparatus for their calibration and determination of zero and boiling points are supplied; also apparatus for determination of coefficients of expansion, for latent and specific heat and calorimetry.

The optical rooms are furnished with spectrometers of different designs, spectroscopes, telescopes, microscopes, sets of lenses, prisms and gratings, optical benches, photometers and apparatus for colorimetry, polarized light and spectroscopy.

In the rooms devoted to electricity are galvanometers of various patterns, high and low resistance, ballistic and damped; electrometers, magnetometers, standard cells, resistances, rheostats and bridges of all types; condensers, batteries, keys, arc and incandescent lamps, amperemeters and voltmeters.

THE MECHANICAL ENGINEERING DEPARTMENT.

The Mechanical Engineering department is located in the Engineering Building and in the Annex, the space and equipment provided for it being greatly increased at the new site. This improvement is made not only on account of the importance of this branch in the electrical, civil and mining engineering courses, but also because regular courses in mechanical engineering have now been opened at Columbia for the first time, the space at the old site not having been adequate for the purpose. The department has the following equipment:

The wood-working and machine shops are located in the Teachers' College, 120th street. For wood-working there are carpenters' benches with their kits of tools, speed-lathes, saw benches and planers. For forge and blacksmith work there are forges with anvils and tools, a Bradley hammer and a Billings & Spencer drop-press. For metal working there are engine-lathes with swing from twelve inches to twenty inches, planers, shapers, drill-presses, a universal milling machine, universal grinding machines and a Jones & Samson turret-lathe.

The testing laboratory is equipped with high-grade testing machines for tensile, transverse, torsion and compression tests. Their designs are of diverse types to give wide experience in handling, and they are fitted with the best and newest appliances for observing and recording deformations of test-pieces. The Emery testing machine of 150,000 pounds capacity is used as a standard of reference.

The Mechanical Engineering laboratory is well

supplied with dynamometers of transmission and absorption types, with oil-testing appliances, speed recorders, tachometers, weighing and measuring apparatus, anemometers, gauge testers and the like, and representative machines and mechanisms for calibration and tests of efficiency.

The Steam Engineering and Motive Power Laboratory has an extensive series of indicators, with appliances for calibrating and standardizing them, test-gauges, thermometers, calorimeters, pyrometers and apparatus for boiler and engine tests. A triple expansion steam engine of the Reynolds-Allis-Corliss design is arranged to work as an experimental steam engine by making it a three-stage air compressor when so operated, and having all facilities for the accurate measurement of efficiencies. A full line of boiler-feed injectors is mounted for display and experiment. Steam engines of various other types, steam pumps, a ten-horse-power De Laval steam turbine, hot-air and gas engines are at hand, and surface-condensing appliances as well. The department has also a cross-compound two-stage air compressor, the cross-compound steam end of which with reheater, combined with the cross-compound air end with inter-cooler, makes a most complete example of applications of thermo-dynamic theory to practice. This laboratory is known as the Allis Laboratory in memory of the late Edward P. Allis.

The Hydraulic Motors Laboratory contains tanks, weir-notch equipment gauges, current-meters, water-meters, and motors for test and experiment. Constant pressure is secured by air-pressure upon the water in a closed tank, thus doing away with a stand-pipe. For heavier pressures, above 100 pounds per square inch, an adjustable accumulator is used. Pumps of large capacity give the necessary quantity of water for orifice tests and other drill in hydraulic engineering. The equipment of this laboratory is presented as a gift to the University as a memorial of the late Henry R. Worthington of New York City.

The Drawing Academies are particularly well lighted and of large extent, and are fitted with the best forms of drawing tables and furniture, as well as extensive collections of patterns, models and illustrative drawings, blue prints, photographs and prints which are useful as copies and for training in design.

The cabinets or museum collections of Mechanical Engineering exhibit models of mechanical movements, mechanisms and gearing, also material which has failed in service and under test. Specimens of apparatus and materials for practice are also included.

The Chemical Department occupies Havemeyer Hall, which is located at the northwestern corner of the group of buildings. It contains several chemical lecture rooms fully supplied with apparatus and instruments and all modern facilities for the experimental illustration of the different lecture courses.

The Museum of General Inorganic and Organic Chemistry and of the Chemical Arts contains the elements and all their more important compounds; representative sets of specimens of all classes of compounds, materials and products, together with models, pictures and diagrams.

The Qualitative Laboratory is provided with tables, reagents and all the necessary facilities to enable each student to become familiar with the reactions of the different metals and salts.

The Quantitative Laboratory is provided with tables, reagents and all the necessary apparatus and instruments to enable the student to actually execute quantitative analyses.

There is also a laboratory specially fitted up for electro-chemical work.

The theoretical as well as practical branches of electrical engineering are taught by Professors F. B. Crocker and M. I. Pupin and by Messrs. G. F. Sever, W. H. Freedman and S. G. F. Townsend.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

A SURVEY OF THE POSSIBILITIES OF ELECTRIC HEATING AND COOKING.*

BY W. P. ADAMS, A.K.C., A.I.E.E.

(Concluded from page 118.)

I have so far made no comparison between the cost of cooking by electricity and that by other means. I shall not deal with this question much in detail, as I think it more practical at the present time if a general idea is given as to what the actual consumption of electricity will be, for the cost by other means varies largely under different circumstances. I have, however, some figures to hand obtained in a kitchen where both gas and electricity could be used at will. The household was a small one, consisting of about five persons, and the consumption of electricity was approximately 30 units per week when cooking was done solely by this agency. When gas was employed exclusively 1,240 cubic feet of gas were used during a week. The cost then of electricity at 2½. per unit is 5s. a week, and of the equivalent amount of gas at 3s. per 1,000 cubic feet is 3s. 9d.

The figures of consumption which I have given above are the most complete at my disposal, and this is my reason for bringing them before your notice, but I have other results to hand which indicate that the consumption of current may be reduced below the figures given when the appliances are used intelligently and with care. For small installations such as we have considered, one may assume roughly that a unit per head per diem will suffice for all cooking purposes. These figures will naturally be reduced in larger establishments, and experience seems to point to about 1s. 2d. a unit as a sufficient allowance in kitchens where more than 30 or 40 persons have to be provided for. The best results will be obtained where there is a hot water supply. Many of you are probably aware that heating water by electricity is a most uneconomical proceeding, at any rate at the present prices, and where an establishment is sufficiently large it is always recommended that a slow combustion stove be fitted to supply all the hot water for the household. In many houses such a stove is already fitted.

There is one direction in which one might anticipate a large development of electric cooking, and that is in flats. If architects will arrange for a general hot water supply for the whole building, as I believe is now done in many cases, electric cooking presents such an advantage that an important movement in this direction should take place when the supply companies are convinced of the advantage of charging such prices as will be generally acceptable. I think I have said sufficient to indicate that even with electricity at 3d. per unit electric cooking is not extravagantly expensive, and if its other great advantages are taken into consideration, particularly the economical results from the perfection of the cooking, it ought to be received with prompt favor.

I am hoping that before long those responsible for electricity supply will begin to make a definite move in the development of electric heating and cooking. It is not sufficient to merely reduce the price of electricity to a reasonable figure, as many of the Corporations have already done, but steps should be taken to induce people to become users of electricity for other purposes than lighting. It may be said that such steps are not in the province of electric supply concerns, but if the Corporations undertake the supply of light to towns, it is surely obvious that it is to their advantage to put every facility in the way of the ratepayers to use as much electricity as possible. It surely needs no argument to convince a company that its policy should be to try and obtain as many users as possible, whether for lighting or power or heating, as every unit sold means a

certain amount of profit. It must therefore be of advantage to a town undertaking its own supply to sell as much electricity as it can, not in this case in the interests of shareholders, but in the interests of the ratepayers. The hire system, which the gas companies are much in favor of, should be adopted where possible. One of the difficulties which have been met with in the attempt to develop electric heating is the high first cost of the apparatus. This is largely owing to the comparatively small output of heating apparatus at the present time, and is also owing in no small degree to the many different voltages which the goods have to be made up for. You will probably be surprised to learn that there are no less than 14 different voltages in general use at the present time, and you will quite appreciate that this does not tend towards the cheapening of the appliances.

I have little doubt, if supply companies are prepared to give this matter their careful attention, that mutually satisfactory arrangements might be come to between themselves and manufacturing firms so as to meet these difficulties.

It may be worthy of mention in passing that many supply companies and local authorities have no power to hire out apparatus in the same manner as the gas companies; and in view of the probable development in this direction, I would recommend that all companies and authorities applying for powers in future should include this in their application. Existing companies can obtain the necessary powers by taking the usual legal course.

I have now to consider the practicability of using cooking and heating plant in connection with plant installed for lighting residences and factories.

In very few well-arranged and properly-managed private installations does the cost exceed 4d. a unit, and in residences where accumulators are used it would simply mean running the plant a few hours a day extra if electric cooking apparatus were adopted.

Assuming that the extra wear and tear of the plant is negligible, which I am justified in doing, and that the man in attendance has to devote most of his time to the electric lighting plant, the only additional cost incurred is the additional fuel consumed and oil and waste used. This may vary between ½d. and 2d. per unit.

In the case of a gas engine supplied with town gas at 3s. per 1,000 cubic feet, and consuming 20 cubic feet per brake horse power hour, the cost per unit would be 1.18d. In the case of an engine supplied with producer gas, and consuming 1½ lbs. of coal per brake horse power hour, the cost would be .26d. per unit, with coal at 20s. per ton. With steam plant, the cost of coal consumed will vary considerably; but in no case where reasonably economical plant is installed should it exceed 2d. per unit.

In factories where large electric lighting plants are in use the same argument holds good. The probability is that the generating engines are supplied with steam from the main boiler system, and the man in attendance on the general machinery is expected to look after the electric lighting plant. The cost of generating electricity during the daytime for cooking meals for the staff of this establishment and perhaps for the employees, is, in such a case, almost a negligible quantity.

It may be considered superfluous to mention that water power installations form an ideal opportunity for the employment of electric heating, as in this country the amount of water power available is but small. It will be obvious to you that in country houses lighted by the agency of water power there could be no cheaper means of cooking and heating than by running the generating plant during the day. The cost of fuel is nil, and it is a fact that in many country houses in Scotland, where coal has to be carted many miles, such installations are in existence, and there should be no hesitation in recommending the adoption of heating and cooking appli-

ances. As a matter of fact, several houses have already adopted this plan with great satisfaction.

Abroad, of course, the conditions are different. Large water powers are available in different countries, and there at any rate should be a field for the development of heating and cooking in which they would stand absolutely unrivalled. The largest order for electric radiators ever received was placed not long ago for heating offices supplied from a water power installation.

I must here make a small digression to call your attention to the curious ideas some people hold with regard to electric cooking. An establishment in Liverpool had just installed a large and economical plant for electric lighting purposes, and it had been proposed to the owners that they should use it during the daytime for cooking purposes. I was asked by the electric light contractors to loan some apparatus for testing, and, the conditions being distinctly favorable, this was done. A little later I was informed that the committee would not adopt electric cooking. I was anxious that the test should have been made under my supervision, but it was not thought necessary for me to be present. Inquiries were made, and I found that the committee itself had superintended the experiments and had insisted upon the food being placed on the appliances before current was turned on. As one of the elementary rules of cooking is that the apparatus should be heated up to the proper temperature before the food is placed upon it, you will understand that such an experiment was foredoomed to failure. I relate this instance as an illustration of the common idea that electric cooking apparatus is capable of doing things which no one would think of expecting from ordinary cooking apparatus, and simply for the reason that the word "electric" is used in connection therewith. Every electrical engineer at one time or another has met with peculiar ideas of this sort.

There is nothing of course, nothing magic, about electric heating and cooking appliances. The advantages which we claim for them is: (1) that they are more economical in point of heat utilized than any other appliances, (2) that they are quite without equal in point of cleanliness and general convenience, (3) that there is practically no waste of material in the cooking, (4) that by their means cooking is reduced to a simple science, and absolutely uniform results can be obtained, this being due to the ease with which the heating effect is controlled by switching. In the oven it is usual to fix a thermometer indicating on a dial on the front of the door, and given temperatures can be maintained within a few degrees. I might further claim that such appliances are perfectly free from such dangers as attend the use of gas cookers. Explosions are impossible and the risk of fire is nil.

I must now beg of you to spare me a few minutes for the consideration of electric heating by radiators. I have already indicated at the commencement of this paper that this subject requires consideration from quite a different point of view to electric cooking. Assuming for the moment that there is likely to be any large development, you will at once observe that this will bring no load to the stations during the summer time, and, owing to the large amount of current the radiators consume, they will make the winter load heavy. It may be that persons who adopt electric cooking may be inclined to use the apparatus during the summer time only, on account of its coolness, in the same way as people now adopt gas ovens, returning to the use of the kitchen range in winter. If this were done to any large extent it would probably meet the difficulty, and it might even be desirable for supply companies to give special terms for the use of electric cooking appliances in summer, and increase these charges during the winter. Whether such a plan is feasible or not will have to be ascertained as the problem develops.

When estimating roughly what current radiators are to be wound for, for a given space, I generally

* Read before the Northern Society of Electrical Engineers, Manchester, Eng., January 24, 1898.

assume that 500 watts will be necessary per 1,000 cubic feet of space, in the coldest weather. This, of course, is only a very rough guide, and in every case the general conditions must be taken into consideration. In my office in the city, which has a capacity of 2,000 cubic feet, with one outside wall almost entirely consisting of window space, I rarely use a larger radiator than one absorbing 600 watts. In sharp weather I have found it necessary to put two of these on for the earlier part of the morning, and sometimes on Mondays, after a continued frost extending over Saturday and Sunday. In this instance it will be seen that a less quantity is required than 500 watts per 1,000 cubic feet of space. In the case of a building with several thin outside walls and other unfavorable conditions, probably more than the 500 watts would have to be provided for.

With radiators consuming this amount of energy you will appreciate that electric heating is not likely to receive much support when such charges as 8d. per unit are made. At the beginning of last year I was requested by an architect to fit nine radiators in a spacious office in the city. The firm was a wealthy one, and expense was not considered an important matter owing to the convenience of the electric radiators. I pointed out before the order was placed that the cost of current would probably be very high; but, notwithstanding my warning, it was decided to have the radiators fixed. After they had been running for three or four months I was informed that the cost was so excessive that their use would have to be discontinued. With one or two small exceptions these are the only radiators ever installed in the city of London; and, while the prices are maintained at the present figure, little development is likely to take place; and yet the city is an almost ideal place for the use of electric radiators, owing to the fact that the bulk of the offices close at an early hour, and that the occupiers are willing to pay a good price for so convenient and sanitary means of heating as electric radiators provide.

Experience shows that even at so high a figure as 3d. or 4d. there is considerable demand for electric radiators, and this is not surprising when one considers that the heat produced is of exactly the quality that one could desire. It is not sufficiently high to deprive the air of its moisture. There are no products of combustion to vitiate the atmosphere, and the radiators are turned on and off with the same ease as the electric light.

It is, of course, obvious that persons of means will be the first to adopt electric heating, and that, as the price diminishes, so those of less liberal incomes will be able to avail themselves of this method of heating. This is simply a repetition of the experience met with in connection with the electric light.

There is one direction in which electric radiators should prove valuable, and this is in ship heating. The present system mostly in vogue is steam heating, and this is constantly a recurring source of trouble and vexation and also of expense. Electric radiators can be fitted on board ship with very much greater ease than steam radiators and piping, and give absolutely no trouble when once installed. The cost of installation, including the additional generating plant, is very little in excess of the fitting of steam heaters, and in some cases may be even less. I am sorry that the time at my disposal will not admit of my enlarging on this and many other points of interest in connection with electric heating.

During the last few minutes left at my disposal, I would briefly call your attention to other directions in which electric heating is capable of considerable development. Hot cupboards, for use in dining rooms and serving rooms of private houses and clubs have been received with some little favor; and as they are generally brought into use after the main work in a kitchen is finished, they will doubtless help to fill up the dip in the load curve which occurs after midday and during the progress of late dinner. While they take a considerable amount of current while heating up, they are not in use for sufficient

time to make the cost of much account. Hot plates of various types are in use, for keeping plates and dishes warm during meals, in a similar manner in small establishments where hot cupboards would not be required, and these would all be a help towards filling up the after-dinner depression in the load curve.

I cannot now make detailed mention of the smaller heating appliances, but I think that their employment is one worthy of some consideration by supply companies. If they are at all largely adopted, they would be of value in increasing the day load, and it is likely that they would be employed at times when the cooking apparatus would not be in use. Take, for instance, the electric kettle. Each kettle takes from 300 to 500 watts, and they are mainly used for preparing tea in the afternoon. It is conceivable that, if used in large numbers, they would help to fill up the somewhat awkward dip in the curve occurring about 3 or 4 o'clock in the afternoon, after the hot cupboards and plates had gone out of use.

In conclusion, I will ask you to be as lenient as possible when passing judgment upon this paper. I am well aware that I have been guilty of some temerity in venturing to read a paper upon a subject about which there is so little practical knowledge. My excuse for doing so is that I believe there is a reasonable probability of considerable development in this direction in the near future; and I hope that the figures which I have placed before you may help electrical engineers and others interested to understand better the claims that this branch of electrical engineering has upon them. I have attempted to deal with the problem as widely as possible, and I hope that the aspect of affairs from the central station engineer's point of view may receive some consideration during the discussion.

AN ELECTROLYTIC PROCESS FOR THE MANUFACTURE OF PARABOLIC REFLECTORS.*

BY SHERARD COWPER-COLES.

(Concluded from page 120.)

During the several operations that have been described, the glass mould (which in the case of large reflectors is of considerable weight) is handled by means of a sucker placed on the concave side of the mirror. The silver mould when silvered and burnished is placed in a ring, marked B in Figs. 1 and 3, which is attached to the frame, D; the ring serves to form an electrical connection with the silver coating. To determine the size of the reflector that is to be formed, and to ensure a clean edge, a ring, N, Figs. 2 and 3, is placed, having the proper internal diameter, and bearing at its inner edge against the mould, as shown in the figures. Wooden blocks, G, of the required thickness are inserted between the rings B and N, and the ring is secured in place by the clamps, O, as shown in Fig. 2. The ring N may be made of insulating material, or it may be a brass, copper or lead ring, having its lower face protected by suitable varnish to prevent the deposition of metal upon it. The ring B, Fig. 1, is suspended by bolts, C, and cross-bars, D, forming a frame which is connected to vertical shaft, E; the said shaft is carried on the main frame, E, of the apparatus by a bearing fitted with ball bearings marked F², which supports the shaft by means of a collar, and is allowed to rotate freely. G is a pulley through which shaft E and mould A may be rotated by a belt or cord. The depositing tank is carried by a frame, to which the mould is suspended, so as to be in contact with the electrolyte, which is a solution of copper sulphate; the anode is arranged at the bottom of the tank, and the current conveyed to it by means of copper strips. It is found advantageous to have the anode flat, as it reduces the tendency for the copper to "tree" at the edge of the mould; it also has the additional ad-

vantage of rendering the reflector thicker in the center. The electrical connections between the negative terminal and the silver coating of the reflector is made through the ring B, bolts C, strips of metal, D¹, on the arms of the frame D, the shaft E, the ball bearing F². Fig. 6 is a perspective view of the cross frame for suspending the mould, and shows the metal strips for conveying the electric current. The connection of the frame to the shaft is made by a joint, E³, that allows of the mould being tilted, for the reason that I will now describe to you. When

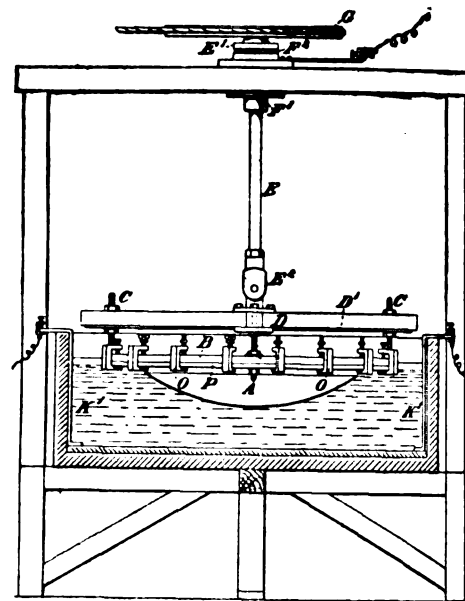


FIG. 1.

first lowering the mould into the solution it is advisable to avoid throwing the work of carrying the whole electric current on the silver alone, so the shaft E is raised by means of pulley blocks, or otherwise, to suspend the mould. The mould is then tilted and the shaft gradually lowered, bringing the edge of the mould in contact with the electrolyte, the circuit being thus established. A thin film of copper is deposited on the mould at the place of contact near the edge of the mould. The shaft is then lowered until it rests on the bearing; at the same time the mould is allowed to gradually assume its horizontal position. The operation I have just described occupies a very brief interval of time, and the current for a few minutes is worked at a pressure of about 9 volts, which is ultimately reduced. It is very important that the silver be flashed over with copper immediately on immersion in the copper sulphate solution. At this stage the ring N is not applied, and the mould simply rests on the ring B. The shaft is then rotated, and the operation of depositing the base metal continued with a current density of about 19 amperes per square foot, and is proceeded with until a sufficiently thick coating is obtained to act as a good conductor to the electric current. The copper solution generally used is of the following composition: Copper sulphate, 13 per cent.; sulphuric acid, 3 per cent.; water, 83 per cent. The ring B, with the mould in it, is then lifted out of the bath, and the ring N applied to de-

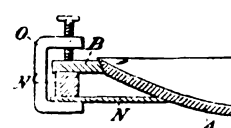


FIG. 2.

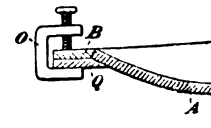
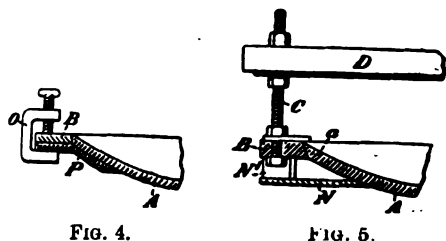


FIG. 3.

termine the size of the reflector that is to be formed; after which the mould is again placed in the bath, and the operation of depositing the backing proceeds until the required thickness is obtained. During this stage the copper is deposited on the mould up to the inner edge of the ring N, which thus determines the diameter of the reflector, and also ensures a clean, even edge to the reflector, which requires no further treatment. In place of the ring N, shown in Figs. 2 and 3, a leaden ring, P, Fig. 4, may be employed. The leaden ring is secured to the ring B

* Paper read before the Institution of Electrical Engineers, London, February 9, 1898.

by the clamps O; this ring, being soft and pliable, will bend to the angle of the mould and the ring B, and therefore does not require to be blocked up as does the ring N. Fig. 3 shows a modification of a mould having its edges bevelled in the direction indicated—that is to say, in the reverse direction shown in Fig. 2. In such cases the mould is supported by a number of narrow rigid supports, Q, clamped to the ring by clamps O. After the thin coating of copper has been applied to the mould in the manner already described, the ring B, with the mould in it, is removed from the bath and turned over. The supports Q are then removed, and a ring such as P, Fig. 4, is applied to the mould to determine the size of the reflector. Or, instead of removing the supports Q and applying the ring P, if a ring such as N, Fig. 2, can be applied to the mould,



it is then replaced in the bath and the depositing continued. As soon as the requisite thickness of metal has been deposited, the mould, with the reflector attached to it, is removed from the ring B and placed in a bath of cold or lukewarm water, which is then raised to a temperature of 120° Fahr., whereupon, owing to the difference of expansion of the glass mould and the metal backing, the latter separates from the mould. The only thing that requires to be done now is to coat the reflector with an untarnishable metal. This is accomplished by placing the reflector in an earthenware pan (Fig. 7) containing a 0.62 per cent. solution of palladium ammonium chloride in about a 1 per cent. solution of

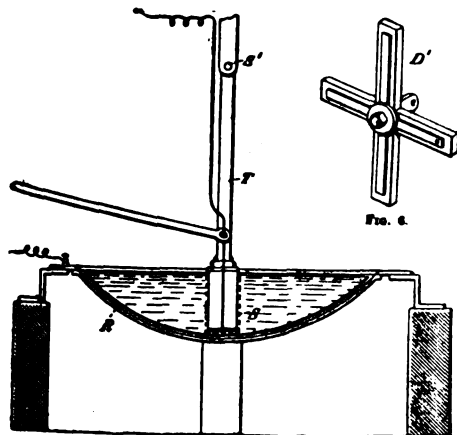


FIG. 7.

ammonium chloride. The solution is used at about 75° Fahr., the current used for a 2-foot reflector being about 0.5 of an ampere, the EMF. at the terminals of the bath being 4 to 5 volts. An anode, S, made out of carbon, and curved approximately the shape of the reflector, is attached to a rod marked T, which is connected by an arm to a rotating disk which causes the anode to swing to and fro, thereby ensuring an even coating of palladium, and agitating the solution and preventing the depositing upon the reflector of particles of foreign matter which may be present in the solution.

The back of the reflector is usually varnished before placing it in the bath, to prevent local action setting up between the copper and the silver or palladium. The reflector is removed from the bath and dipped in boiling water, and then placed in box-wood sawdust, which is kept hot by means of a steam jacket. The reflector is then ready to be mounted in a suitable ring, such as shown in Figs. 8, 9, 10, 11 and 12. The clamping ring shown in Fig. 8 is provided with a knife-edge, marked F, Figs. 10 and 12. The knife-edge forces the reflector against a ring of

asbestos, marked G, and retains it in position after the reflector has been carefully centred whilst resting on the asbestos ring.

Reflectors made by the process which has just been

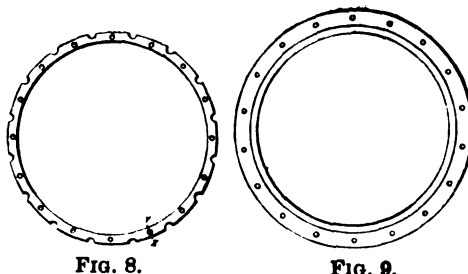


FIG. 8.

FIG. 9.

described have been subjected to a number of tests, and found to withstand excessive heat without tarnishing. Salt water has been thrown on the reflectors when they have been too hot to touch, the result being that the water was driven off as steam, and the salt left as a white deposit on the reflector, which was easily removed with a wet cloth.

A reflector recently tested at Portsmouth had a number of rifle bullets passed through it, when the beam was found to be little affected. On the other hand, the first shot fired at a glass reflector splintered it to pieces.

Although palladium does not reflect light as well

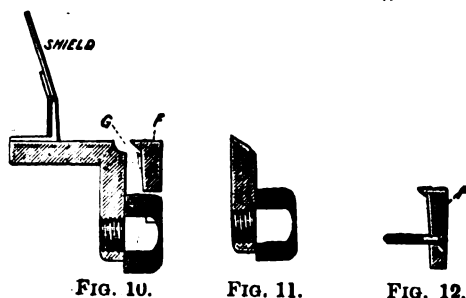


FIG. 10.

FIG. 11.

FIG. 12.

as a silver surface which is perfectly clean and bright, silver is found quite unsuitable, as after being in close proximity to an arc light for a short time the silver tarnishes, and the light is greatly reduced in intensity. With a palladium-faced reflector the intensity of light is found to remain practically constant, as little or no tarnishing takes place.

Some of the reflectors have been tested optically by the process which has been extensively used by Thikolff. The method consists of photographing the image in a reflector of a white screen covered with black square network, as shown in Fig. 13. The screen is of white material having a black square network, the lines being 0.2 inch thick and 0.6 inch apart. In the center of the screen a square opening is left, through which the photograph of the image of the network is taken. The first steps in the process are as follows: The reflector is placed at a distance of from 3 to 5 feet from the screen, which

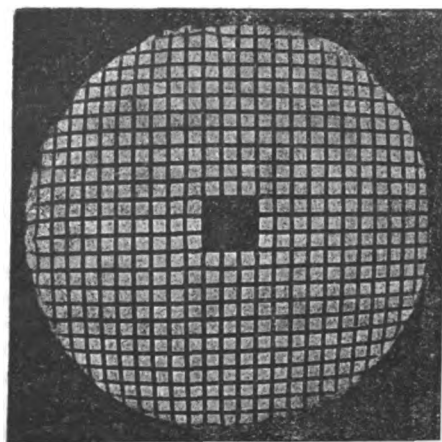


FIG. 13.

should exceed by at least 35 per cent. the height and breadth of the reflector, so as to ensure the image of the network covering the whole surface of the mirror. The test of the reflector is carried out as follows:

The surface of the mirror in all planes is tried by a template, to ensure that the exterior curves of the surface are not far distant from the parabola; the image on the screen is then photographed, and the irregularity of the lines indicate any serious errors of the parabolic surface.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE ELECTRICAL EQUIPMENT OF THE MAINE.

An extended description of the electrical equipment of the battleship Maine, sunk at Havana, and perhaps the most talked of battleship in the world during the last three weeks, would be sufficiently large to fill a fair-sized volume.

At the Bureau of Electrical Equipment of the Navy Department, the following facts of interest to electricians generally were learned: In the first place, none of the wires were allowed to run near the magazines or rooms where the explosives were kept, and as the chief clerk of the Bureau remarked, the explosion could not possibly have proceeded from that source.

There were 4,200 feet of double length mains; total amperes, 248; carried amperes, 163½; 1,045 feet of double length feeders, total amperes, 225.

The lamps and attachments were as follows (they are divided for convenience into "battle" and "lighting"):

151 ten candle-power, 84 sixteen candle-power and 10 thirty-two candle-power lamps in the "battle" division, and 153 sixteen candle-power lamps in the "lighting" division. This makes a grand total of 398 lamps, with a total candle-power of 5,622.

There were 183 junction boxes in the "battle" department and 96 in the "lighting" department, a total of 279.

In the "lighting" department there were 33 outlets.

In the "battle" department there were 101 receptacles and in the "lighting" department 25, a total of 126.

There were 45 switches in the "battle" department and 18 in the "lighting" department, a total of 63.

Of sockets, there were 245 in the "battle" department and 153 in the "lighting" department, a total of 398.

In the "battle" department there were 231 fixtures and 149 in the "lighting" department, a total of 380.

In addition to these were two large searchlights, one fore and one aft.

There were two dynamos and engines directly connected and secured to the same bedplates. The bedplates were made as light as practicable consistent with necessary strength and rigidity, and had suitable provision for securing tachometers and for catching the waste oil. The dynamos were connected to a switchboard from which all of the circuits for incandescent lamps and motors were supplied, and the motors and incandescent lamps could be operated at the same time. A ground detector and two direct-reading voltmeters were supplied with the plant.

The cylinders and other parts subject to steam pressure were guaranteed to successfully withstand a water pressure of 200 pounds per square inch, and to bear without injury the removal of the entire load by suddenly breaking the external circuit of the dynamos.

The engines were two-cylinder, double-acting, not compounded, direct-acting, and vertical, and were directly connected to the armature shafts by means of flexible couplings, and were capable of driving them at a speed of 500 revolutions per min-

ute when the dynamos were generating their maximum output. The initial steam pressure was 60 pounds, exhaust either atmospheric or vacuum.

The engines were fitted with the most efficient kind of lubricating devices and guards to catch flying oil.

The dynamos were compound wound and self-regulating, producing with 500 revolutions of the armature per minute a constant electromotive force of 80 volts measured at the terminals. Under these conditions each dynamo had a capacity of 25 amperes, and within these limits there was only a variation of $1\frac{1}{2}$ per cent. in speed at load to produce the required electromotive force.

There was no single wire larger than No. 14 B. W. G. used in the wiring, and it had to conform to the Naval standards in such cases.

The incandescent lamps were arranged in six sections from the main switchboard.

mitters were located in the engine rooms and the indicating dials in the conning tower and on the bridge or in the chart house.

A direct reading rudder transmitter showed the angle of the rudder with the keel and was connected with dials placed on the bridge at the steering engine and in the conning tower. This angle was shown at all the stations on the same instant.

There were also heeling indicators to show the angle of heel and the angle of roll and were located in the chart house and two other places on the upper deck. The dials of all the telegraphs and indicators were lighted by electricity and the necessary energy was supplied for the instruments from the dynamo circuits. There was a reserve battery for use in case the dynamos were not in operation.

There were thirty-three voice pipes or telephones on board the ship, eleven buzzers, two bells, two gongs, an automatic water alarm circuit and twelve

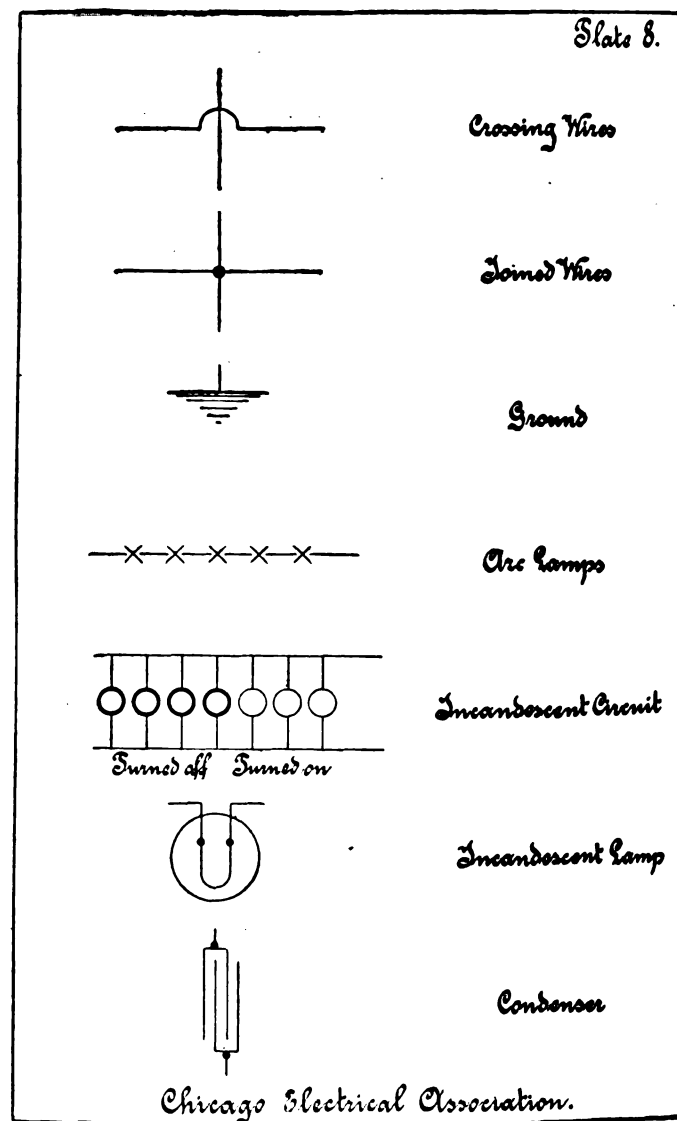
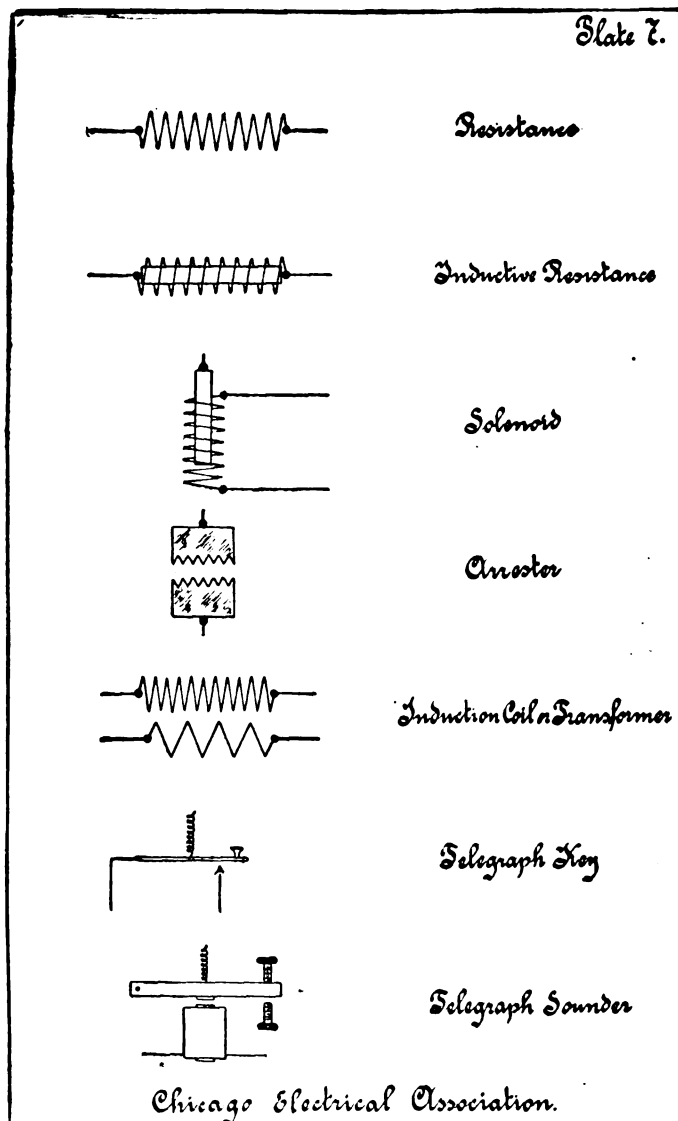
STANDARD SYSTEM OF ELECTRICAL DIAGRAMS.

(Concluded from page 119.)

The distinction between the ordinary resistance and inductive resistance as shown in Plate 7 is both simple and suggestive, the presence of the core inside of the coil conveying to the mind the presence of a certain amount of self-induction.

The use of two parallel zigzag lines for induction coils or transformers lends itself readily to the distinction between the primary and secondary, between the step-up and step-down transformers, and, moreover, its construction is of such a simple nature that it was chosen without hesitation by the committee from among dozens of other good diagrams for representing the same apparatus.

In the telegraph sounder the magnet coil has been represented in outline. In this connection it may



There were three electric motors installed on board, with an aggregate of four horse-power. Each motor was directly connected to a countershaft and had a constant speed of 150 revolutions per minute, and was self-regulating and reversible.

There were electrical telegraphs with dials in each engine room and connected to transmitters in the conning tower and in the chart house (or on the bridge), whereby the number of engine revolutions desired could be easily transmitted. These telegraphs were so constructed that messages could be repeated back from the engine room. There were telegraphs of the same character with repeating dials at all steering wheels and steering engine and connected in the same manner as the engine room instruments, and were so constructed that at all stations the angle was indicated at the same moment.

The indicators were direct reading electrical indicators and showed the direction and number of revolutions of each of the main engines. The trans-

ten-inch clockwork alarm gongs with electrical escapements, five on the berth deck, two in the ward-room, one in the junior officers' quarters, one under the forecabin and one on the main deck under the middle superstructure.

Roentgen-Ray Work in English Hospitals.

The X-rays are being very extensively used in surgical and other work in the hospitals in London. During the year 1897 as many as 416 patients were examined in the X-rays department of St. Thomas's Hospital, Albert Embankment, and the increased work has made necessary the appointment of another assistant in that department. At a Liverpool hospital during the past twelve months fifty-seven cases were facilitated by the same kind of treatment.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

be said that where it is not essential to know the nature of the winding or the direction of the convolutions, this same form of magnet might be adopted in any of the relays or annunciators used elsewhere in these diagrams.

The selection of a symbol for "a ground" which might be universally accepted is apparent. The custom of some artists of placing palm trees and grass, or the drawing of miniature landscapes surrounding their ground wire, may add somewhat to the artistic effect, but certainly nothing to the clearness or merit of their work.

In conclusion it may be said that it is believed that where any particular piece of apparatus is to be presented for which no specific diagram is here found, it will be an easy matter for the person desiring such diagram to make it from the elements here shown.

By the official adoption of these diagrams by a recognized body of electrical men, a standard of uniformity is presented to the public. The committee realizes that this list is not complete, but hopes that

it will be a nucleus of a uniform symbolic language among electricians.

The committee, from whose report we have abstracted the remarks accompanying the plates, was composed of Thomas G. Grier, Kempster B. Miller and C. Wiler.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

PROPOSALS INVITED.

The United States Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until March 29, 1898, for all the labor and material for supplying an electrical installation for the experimental model basin now being equipped at the Washington Navy Yard. The object of the installation is to supply the necessary power for driving a model towing carriage at various uniform speeds, from the slowest up to an actual speed of not less than 2,000 feet per minute. The Government will supply the model towing carriage, exclusive of driving motors and all other electrical attachments. In the installation of the plant, the Government will prepare the foundations, will make the necessary steam connections, and will plant the necessary outside poles for carrying electrical circuits. All other work, including generators, engines, motors, switchboards, instruments, all wiring, etc., must be supplied and installed by the contractors. The motors must be designed in conformity to the space shown to be available on towing carriage plans, an increased length of motor only being permissible, provided a suitable rearrangement of bearings can be made without interfering with other parts shown on the plans. They must be wound for a maximum voltage of 250, and at this voltage, with all four motors acting through the gearing shown on plans, must develop the necessary power for attaining the highest speed as specified, the speed of armature being about 800 r. p. m. Motors are to be controlled on the Ward Leonard system or one similar in results and efficiency. The fields of each motor to be provided with a rheostat, and a Weston ammeter and voltmeter to be connected in the armature circuit of each, and also in the main circuit. The generators for supplying the necessary current to be preferably in two similar units and of ample size to supply the maximum power referred to when running in parallel. A third machine to be provided for separate excitation, with surplus capacity for lights up to 1,000 CP. Generators are to be of the multipolar direct connected type, both generator proper and engine to be of standard approved pattern. The engines are to be of the direct-acting, non-condensing type, specially constructed to receive the generators. Contractors will be expected to supply the switchboard in power station, to supply material for and do all necessary wiring in connection with the complete installation as well as supply and install all the conductors in the building. The wiring between buildings will be overhead work and the Government will supply and plant the necessary poles.

Prospective bidders desiring specifications, blank forms of proposals, and any information considered essential, in addition to that contained herein, can obtain same upon application to the Paymaster General, U. S. Navy, Washington, D. C.

The Telegraphic Tournament.

Regarding the Telegraphic Tournament to be held during the Electrical Exposition in Madison Square Garden next May, and which we referred to at some length in a recent issue of *ELECTRICITY*, it is said that Mr. Thomas A. Edison, who always takes great interest in contests of this nature, will make a phonographic record of the best transmissions, noting the exact time of the revolutions of the machine in order that perfect reproductions can be made at any future time. This will enable the contestants at any time thereafter to listen to the click of the key used in the tournament. It is announced that the matter to be transmitted to the tournament will be the same as that used in the 1893 tournament. In the first 260 words of this matter there are 14 periods, 16 commas, 2 colons, 3 paragraphs, 1 hyphen, 1 dash, 1 interrogation, 1 initial quotation and 1 end quotation.

The rules governing the tournament provide that an omission or addition of any telegraphic character in the matter transmitted shall constitute an error.

As this tournament is to be conducted under the auspices of the New York Electrical Society, its success is practically assured.

Those wishing to communicate with Mr. Fred. Catlin, manager of the tournament, can do so by addressing him, Post Office box 2403, New York.

LEGAL NOTES.

The recently decided case of *Blauvelt vs. Interior Conduit & Insulation Company*, which was a suit in equity by James M. S. Blauvelt, trustee, against the above-named company to restrain the alleged infringement of a patent, touches on a point that is of importance to all men employing laborers. The following extract from the decision of the Circuit Court for the Southern District of New York sufficiently shows the facts and the decision in the case: "The case is, therefore, that of an inventor, who, as a workman in the employ of another, manufactures for him, in his shop, and with his materials, and upon weekly wages, machines which the employer uses as a part of his tools, without knowledge of any objection thereto, and for which the inventor, during the term of his employment, obtains a patent, and thereafter seeks to restrain the employer from the use of the particular machine or machines which had been thus made in the employer's shop under the supervision of the employee, and apparently as a part of his ordinary work. The subject is the same as in the case of *Gill vs. United States*, 160 U. S., 426; 16 S. Ct., 322. The Court said the case raised the question, which has been several times presented to this court, whether an employee paid by salary or wages, who devises an improved method of doing his work, using the property or labor of his employer to put his invention into practical form, and assenting to the use of such improvements by his employer, may, by taking out a patent upon such an invention, recover a royalty or other compensation for such use. In a series of cases, to which fuller reference will be made hereafter, we have held this could not be done." The Court further said that the principle upon which all the decisions were based is "an application or outgrowth of the law of estoppel in pais."

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Agawam, Mass.—The selectmen have extended to March 15 the time in which the Springfield & Southwestern Street Railway Company must be incorporated or forfeit the franchise. The board has informed the company that no further extension of time will be given.

Akron, O.—The receivers of the Akron Street Railway & Illuminating Company have been given authority to improve the local system by building additional tracks and purchasing new cars.

Birmingham, Ala.—The Birmingham Traction Company, which several months ago obtained control of the East Birmingham dummy line running from Birmingham to Gate City, and has converted it into an electric road, has now come into possession of the North Birmingham dummy line, which runs from Birmingham to North Birmingham, a distance of five miles, and will equip it with electricity also, and operate the two properties in conjunction. Together the roads penetrate the most thickly settled suburbs of the city. A large power house, nearly completed, will furnish electricity for the system.

Buffalo, N. Y.—The Buffalo Street Railway Company contemplates running trolley cars over to Canada if Senator Seibert's bill authorizing the enlargement of the International bridge across the Niagara River becomes a law. In this event connection would be made with the Canadian trolley line running down the west bank of the Niagara River to the Falls and Queenstown. The plan is to enlarge the International Bridge so that it will have a track for steam cars, a carriageway, and be of such a double decked construction as to permit of a trolley line in its second story.

Chester, Pa.—The Chester Traction Company are making preparations to begin work on the short sections of road that are needed to give them a through line between Wilmington and Philadelphia.

Detroit, Mich.—Hon. J. E. Sawyer of Pontiac, who was in this city a few days ago, says that financial backing from an Eastern syndicate has been secured for the proposed Pontiac and Flint electric railroad. The road will be 4 miles long, passing through Drayton Plains, Waterford, Clarkston, Ortonville, Goodrich, Atlas and Grand Blanc. It will cost \$500,000. Mr. Sawyer says franchises from the various townships and villages along the route have been obtained and the work of construction

ion will begin as early in the spring as possible. The new road will be incorporated in a few days.

Hellertown, Pa.—The supervisors of Saucon township have granted to Pascoe & Crilly right of way for an electric road from Hellertown to Freemansburg, running through Northampton Heights.

Kansas City, Mo.—The Northeast Electric Railway Company has decided to expend \$100,000 this spring on a new track, new cars and an increase in the power facilities of its electric plant. Roland R. Conklin, vice-president of the North American Trust Company of New York City, which owns nearly all of the stock of the Northeast road, has been here examining the system, and decided that \$100,000 could be spent with profit on new equipment and general repairs for the road.

Meriden, Conn.—Francis Atwater and J. A. Hurley of the Meriden & Southington Tramway Company have deposited a bond of \$1,000 with the borough officials at Southington that the road would be begun by March 31 and completed by August 1.

Mt. Holly, N. J.—The board of freeholders will give a hearing at Mt. Holly on April 5 on the petition of the Monmouth Traction Company for right of way over the roads and bridges in Burlington county included in the proposed route.

New York.—The cable roads in 125th street and Tenth avenue will soon be equipped with electricity and afterward the main cable line of the Third Avenue Company will probably be thus equipped.

Newark, N. J.—The inhabitants of the townships of Caldwell, Livingston and Verona and the borough of Caldwell, whose efforts to secure trolley communication with Newark have so far been blocked by the refusal of the town council of Montclair to grant a franchise to lay tracks through that municipality, have now decided to appeal to the Legislature. Their proposed plan is the enactment of a law which shall give the board of freeholders the exclusive power to grant to traction companies and street railroads the right to lay their tracks upon the county roads.

New Rochelle, N. Y.—The board of trustees has granted the Union Electric Railroad Company of New York a franchise to construct and operate trolley lines over the local streets. The company immediately filed a bond for \$50,000. The franchise gives the right to operate electric cars from the New Haven Railroad station to Starin's Glen Island dock and thence to Larchmont Manor; also a line to Pelham, which will connect there with the present Mount Vernon line, giving the company a through route from Larchmont to 129th street, New York.

Parkersburg, W. Va.—At a recent meeting of the stockholders of the Parkersburg Electric Light & Street Railway Company the contract for building the entire new street railway system was let to L. G. Hallock & Co., of Wheeling, work to begin before the middle of March. The contract price was about \$100,000.

Sandusky, O.—A new electric railroad is being projected which will connect this city with Port Clinton, Castalia, Bellevue and Clyde. The incorporators of the new company are Clark Rude, F. P. Zollinger, A. J. Peters, G. O. French and W. E. Guerin, Jr.

Sheboygan, Wis.—The project for an electric railway line between Sheboygan and Sheboygan Falls has been revived, and there is a strong probability that the road will be constructed and put in operation the coming summer. The greater part of the right-of-way has been secured. The line will be an extension of the Sheboygan electric railway line and will be built by John M. Seaman.

St. Louis.—Mayor Zeigenheim has vetoed the North and South Railroad ordinance and the House of Delegates failed in the attempt to pass it over the veto.

St. John's, N. F.—The Governor has signed the Reid railway contract, which gives Mr. Reid the right to build a railway across Newfoundland and to work the entire railway system of 650 miles for fifty years, with a bonus of 2,500 acres of land for each mile. Mr. Reid agrees to purchase the Government telegraph lines, to run seven mail steamers, build an electric railway at St. John's, and pave the streets of the city. The contract represents \$15,000,000 to the colony and probably many more millions to Mr. Reid.

Washington, D. C.—The amended bill authorizing the Capitol Railway Company to use the overhead trolley on the Navy Yard bridge, which has been acted upon favorably by the House District Committee, will provide that a double trolley shall be used.

Webster, Mass.—The capital stock of the Worcester & Webster Street Railway Company, \$200,000, has been fully subscribed, a large banking house in New York taking \$150,000 of the amount. Everything is now accomplished but the locations in the towns along the route and no trouble is anticipated in obtaining these.

Worcester, Mass.—The "Telegram" says: "A promising sign of spring is the activity of the new electric railway companies and promoters who want to build roads from Worcester into the country. If all the plants under way are put through, Worcester will be a great center of street railway construction and will be provided with unsurpassed facilities to bring in the trade of suburban districts."—The Worcester, Milford, Attleboro & Woonsocket Street Railway Company has applied to the Legislature for a charter and representatives of the company were given a hearing before the railroad committee a few days ago. The line from Worcester to Woonsocket would be 43 miles long, but the company will probably arrange for connections with roads already in operation along portions of the line. Several shorter lines having Worcester as a terminal are projected.

LIGHTING PLANTS.

Bangor, Wis.—A stock company has been organized to put in an electric light plant in this city.

Boston, Mass.—The Senate bill to enable cities and towns to manufacture and distribute gas and electricity for municipal purposes, reported upon adversely by the committee on manufactures, was tabled by a vote of 13 to 1. Another adverse report of the committee on manufactures, on the petition of the mayor of Boston, for the right to own and operate electric-light plants for the purpose of supplying public buildings and parks, was also tabled.

Buffalo, N. Y.—The Buffalo General Electric Company has decided on the old Wilkinson street station as a site for the new station of the company. The old station will be remodelled and equipped with modern machinery at a cost of \$200,000.

Des Moines, Ia.—An election is to be held here on the 28th inst., and one of the questions to be decided is whether the McCaskey & Holcomb contract for a municipal lighting plant, made on the 3d of August last, shall be carried out. The courts decided that the contract was invalid on account of some illegality in the council's action in awarding it.

Grand Rapids, Mich.—Nagel & Ball, electrical engineers of Chicago, have been awarded the contract by the board of public works for superintending the erection of the new municipal electric lighting plant, which is to be built immediately. The contract price for their supervision is \$5,000.

Greensburg, Pa.—Southeast Greensburg borough will probably have electric lights at an early day as the new borough council is in favor of providing the town with a plant.

Gridley, Ill.—I. G. Holdridge and J. F. Lusher have been granted a franchise to maintain an electric light and power plant in this village.

Lewiston, Idaho.—The Lewiston Light Company has effected a reorganization, increasing the capital stock of the company from \$10,000 to \$30,000. The growing demands for lights have necessitated increased power, and the company has decided to establish a power plant on the Asotin creek, two miles above Asotin City, in Washington. The company will also supply Asotin City with lights.

Pine Bluff, Ark.—A proposition has been made to the city council to establish an electric lighting system and street railway in this city which will probably be accepted.

Watervliet, N. Y.—The taxpayers at the election on the 2d inst. voted in favor of appropriating \$16,000 for the enlargement and improvement of the electric light plant.

Woodstown, N. J.—The spring election will decide whether this town is to have electric lights or not, as the vote for candidates will hinge principally upon this question.

TRANSMISSION PLANTS.

Albany.—Senator Daley has introduced a bill in the Senate to incorporate the Jansens Kil Electric Power Company of Hudson, and Mr. Hoos has presented the same in the Assembly. The incorporators named are William A. Harder, Jr., Philip M. Harder and Charles N. Harder, and such other persons as they may associate with them. The purpose is to construct, maintain and operate a series of dams or reservoirs on the Roeliff-Jansens Kil and its tributaries in the counties of Columbia and Dutchess, N. Y., for the purpose of the development of power and for the purpose of furnishing hydraulic and electrical power for manufacturing and other uses, and transmitting such power to a distance by electricity and other means to the city of Hudson and intermediate places in the counties of Columbia and Dutchess. The capital stock of the corporation is \$100,000, divided into shares of \$100 each. The company is authorized to increase its capital stock, but not to exceed \$250,000.

Cripple Creek, Col.—President D. V. Donaldson of the Colorado Electric Power Company says his company will be prepared to furnish power to Cripple Creek miles by the latter part of the month. The structural iron for the main power building has already arrived in Canon City, where the main plant is to be located, and the work of stringing the wires is almost completed.

Saratoga, N. Y.—A syndicate of New York and Saratoga capitalists has purchased, at a cost of \$60,000, the land in the vicinity of Hell Gate Rapids, on the upper Hudson, about seven miles above Glens Falls. The intention is to utilize the great water power at that point as the motive power for a mammoth electrical plant. A dam and power house are to be erected, and, with electricity generated therein, a railroad, to be known as the Saratoga Northern, running between Saratoga and South Glens Falls, will be operated. This road will have branches to intermediate points and also to Glens Falls, Sandy Hill and Fort Edward.

Waterbury, Conn.—There is a scheme on foot to harness the Housatonic River at Shelton, or improve the facilities already there, for the purpose of getting water power to operate an immense electric plant which would supply electricity to all the factories and trolley lines in the State west of the Connecticut River. The Housatonic Water Company of Bridgeport owns the water privileges at Shelton and has a dam there 150 yards long and 25 feet high, and the water power is said to be inexhaustible. It is said the new company intends, if possible, to buy out the Housatonic Company, and supply

electric power to manufactories and mills that have depended for a quarter of a century on the power furnished by the water company.

MANUFACTURING, ETC.

Trenton, N. J.—The bill providing that insulators for electric lights and trolley wires shall be of red glass was reported adversely in the Assembly, but the adverse report was non-concurred in and the bill was placed on the calendar.

New York.—A Cortlandt street firm closed a contract last week for a medium size electric light and power plant for an interior town in Brazil. The contract price was \$18,000.

Indianapolis, Ind.—The Jenney Electric Motor Company has been reorganized and will at once begin rebuilding a plant in this city on a larger scale than that of the plant destroyed by fire.

COMPANY MATTERS.

Lynchburg, Va.—The electric lighting, power and street railway plant, including five and a-half miles of track and valuable franchises, of the Lynchburg Electric Company, were sold at auction on the 28th ult., by commissioners appointed by the United States Circuit Court, for \$31,500 to Walter S. Johnston and R. A. C. Smith, trustees, of New York, for the bondholders there. It is said that the new owners will shortly re-equip the line and put the plant in first-class condition.

Nashville, Tenn.—The resolution providing for the consolidation of the Union Light & Power Company and the Cumberland Electric Light Company, submitted by the special committee with a recommendation of approval, was adopted by the city council.

Providence, R. I.—The act to incorporate the Cumberland Street Railway Company has passed both houses of the Legislature. The company will establish a street car line between Lonsdale and Cumberland Hill.

Richmond, Va.—The bill to incorporate the Harper's Ferry Power Company and the bill to incorporate the Botetourt Electric Railway & Power Company have become laws without the signature of the Governor, owing to the expiration of the statutory limit.—The Governor has affixed his signature to the bill providing for submission to the voters of Grayson County the question of a subscription to the capital stock of the Grayson & Carroll Electric Railway Company.

NOTES FROM A CORRESPONDENT.

Troy, N. Y.—The contract for lighting the streets of the city by electricity for three years has been awarded to the Troy Gas Company, the prices to be for the first year 37½ cents per lamp per night, for the second year 36½ cents per lamp and for the third year 35½ cents per lamp per night. To the same company has been awarded the contract for electric light in the city buildings at ½ cent per ampere hour.

Rensselaer, N. Y.—The common council has extended the time of the Kinderhook Light and Power Company for commencing their service with the city until April 1.

Albany, N. Y.—Maxwell S. Cooley of Kings Park has been appointed chief electrical engineer at Clinton Prison and R. G. Elliott of Avon has been appointed assistant electrical engineer at the same place.

PERSONAL AND MISCELLANEA.

The "Post Express" of Rochester, N. Y., referring to F. W. Hawley, vice-president of the Cataract General Electric Company, for whom a receiver has been appointed by the court, says: "Hawley was a newspaper man in this city a few years ago. He started out without a cent and is now said to owe banks and other corporations over \$100,000."

A special cable dispatch from London, March 4 to the N. Y. "Sun" states that the Vienna correspondent of the London "Daily Telegraph" says that Szczepanik, the inventor of the Fernseher, an electrical teleoptical apparatus which enables any one to see an object in its natural colors no matter at what distance it is away, has sold the right for the public exhibition of the apparatus and all subsequent rights in France to the directorate of the Paris Exhibition of 1900 for the sum of 6,000,000 francs (\$1,200,000).

The Hartford (Conn.) Electric Light Company has secured 150 clocks to regulate the arc street lights that have an alternating current. The time desired for the lamp to be lighted at night and extinguished in the morning is indicated on the dial. When the clock hand catches a certain point it makes a connection and the lamp is lighted. The hand continues to move and when it reaches another point it breaks the connection and the light goes out.

Some citizens of Montclair, N. J., anxious for a new form of entertainment, hit upon what they called a "telephone symposium." They arranged for special quick connections and then listened to short speeches, songs and jokes from a dozen different parts of the country. There was a regular time schedule and the range of the entertainment extended to widely separated points. It proved quite successful and showed the possibilities in undeveloped fields of telephone use.

Dennis Doren, the general superintendent of the Construction Department of the Western Union Telegraph Company, died at Norwalk, O., on the 25th ult., of apoplexy. Mr. Doren was born February 13, 1830, and began work in the Construction Department of the

Western Union Telegraph Company at the age of twenty years. He became president of the American Cable Construction Company in 1881, and held the position during the time the two Atlantic cables were leased to the Western Union Telegraph Company. He was made superintendent of the Construction Department of the Western Union office in 1881.

Manager John I. Beggs of the Milwaukee Electric Railway & Light Company had a narrow escape from being killed on the 22d ult. A large chunk of ice fell from the roof of a building he was passing in Milwaukee and struck him on the head, severely bruising his scalp and giving him a shock that rendered him unconscious for some moments. The Milwaukee "Sentinel," in its account of the accident, says: "The ice struck him squarely upon the head, instead of giving him a glancing blow, and to this Mr. Beggs attributed his fortunate escape from permanent injury. As it was, his hat was torn completely in two. Even the hatband inside was torn across, and his scalp was severely bruised. 'I have been thrown off coal trains, and have suffered a good many hard knocks,' said Mr. Beggs, in speaking of the accident, 'but I never got a blow in my life that left me so completely limp. It may have been my short neck or the shape of my head that saved me from serious injury, but I am sure that the blow would have killed a woman or child, and perhaps many another man.' Mr. Beggs has the hat in his closet, and will keep it as a memento."

A. Werner, a well-known silversmith of Milwaukee, has discovered a method by which signs, pictures and drawings can be made by the combined use of photography and electricity, and the invention may cause a revolution in the art of engraving. He has been experimenting for ten years and has just discovered the method. His process as described in the Milwaukee "Wisconsin" is as follows: "In the first place a drawing must be made of the sign or plate. This drawing is photographed and the photograph transferred to a metal plate, which may be of zinc, brass, copper, bronze, silver or any other metal. This metal plate is then hung on a copper wire into a so-called bath, and an electric current turned on. In a few seconds a copy of the lead pencil drawing is etched into the metal, deep enough to be visible for a hundred years. Then the plate is conveyed to another bath and again connected with the electric current. At this moment the indentures begin to fill with jet black matter until they appear almost even with the surface of the plate. The plate is then washed, dried and varnished with a coating expressly prepared for this purpose. This protects it and saves the trouble of polishing. Signs which are exposed continually to the weather require deep etching and heavy enameling, so that they can be cleaned without injuring the surface. The same process may be applied to pictures and pen drawings, and the copies will last for a thousand years, leaving the contours of the face, etc., sharp and distinct."

RECENT COMPANY ELECTIONS.

Ridgewood Electric Light Company, Ridgewood, N. J.—Directors: H. S. Paterson, H. A. Dunbar, Edwin Clark, D. W. LaFetra, E. A. Walton, John Wilson, Thos. Watlington, E. Le B. Gardiner and J. F. Carrigan.

Tarrytown, White Plains & Mamaroneck Railway Company, formerly the New York, Elmsford & White Plains Company—President, David Cromwell; secretary and treasurer, Herbert T. Jennings; directors: David Cromwell, Bradford Rhodes, Thomas B. Hodge, Clarence S. McClellan and John W. Loundsberry.

Union Railway Company ("Huckleberry"), New York.—Directors: Edward A. Maher, Henry Hart, John E. Parsons, Edward Lauterbach, Albert J. Ellis, Charles Remsen, Henry Iden, David C. Andrews and G. Howland Leavitt.

COMMERCIAL PARAGRAPHS.

Educate Your Bowels With Cascarets.
Candy Cathartic, cure constipation forever.
10c, 25c. If C. C. C. fail, druggists refund money.

The Beautiful St. John's River.

The Clyde Line, operating steamers between New York, Charleston and Jacksonville, Fla., in connection with Clyde's St. John's River line, announce that on the 16th inst. they commenced running the well-known steamers between Jacksonville, Palatka, Sanford, Enterprise and intermediate points, leaving Jacksonville daily (except Saturdays). Returning these steamers leave the various landings daily (except Sundays) for Jacksonville, where connection is made with the Clyde Line steamers for the North. Heretofore the service on the St. John's River has been tri-weekly.

This interesting news will be hailed with delight by the numerous tourists and pleasure seekers who annually take in this delightful trip up the St. John's River.

The beauties of the St. John's River have been heralded far and wide, and there are few Northerners who do not know of at least some of the attractions located on the banks of this river the course of which is directed through the most tropical portion of Florida.

In this section are located hundreds of boarding houses and hotels where the choicest of Southern delicacies may be had.

The Clyde Line does the largest passenger business of any steamer line between New York and the South, and the company has recently issued some very interesting literature, which it is sending out gratis to applicants.

By addressing a communication to the Clyde Line, 5

Bowling Green, New York, our readers will in return be rewarded with some exceedingly attractive advertising matter regarding Southern resorts.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

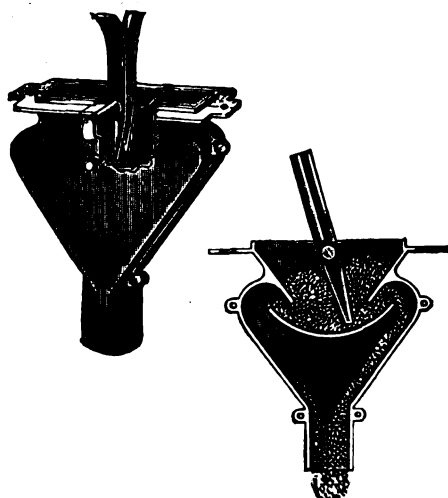
Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

An Improved Sand Box.

The Ham Sand Box, illustrated herewith and sold by the Electric Appliance Company of Chicago, is based upon the theory that any box provided with a valve at its bottom is impracticable, and if the valve be made tight enough to prevent the sand from sifting through it will require great force to operate it, while if the valve be loose enough to work easily it will allow the sand to sift around it. The company also claims that if a pebble get into the valve slide it will hold it open so that the sand will run out of the box.

In the No. 8 Ham Sand Box illustrated, all parts are made of bronze metal. It has an opening in the box, under which is a curved shelf. The ends of the shelf extend beyond and above the opening in the box, so the sand cannot escape by gravity. A paddle is reciprocated above the shelf, and the movement of the paddle forces the sand in



SAND BOX COMPLETE AND IN SECTION.

each direction alternately over the ends of the shelf to the feed spout which leads to the car track. Above the paddle are two fingers which stir the sand. The connecting rod passes forward to the car platform, and is operated by a pin and bell crank lever, or by a hand lever. The working parts are extremely simple and the motions direct. The strokes of the foot or hand may follow each other so rapidly as to practically secure a continuous, but small, stream of sand, a decided advantage in hill climbing. It can be easily seen that waste is impossible in this box, as the sand flows only when the lever is in motion, and the quantity of sand is regulated.

The sand hopper inside of the car and directly over the sand box may be made of any form desired. If the space under the seats is enclosed, a square soap box or any other cheap form of construction may be employed.

Small stones or other small substances will not interfere with the operations of this box, but will pass freely through it. In fact the company recommends coarse in preference to fine sand, even if it contains gravel stones as large as peas, as it is less likely to pack in the box.

The manufacturers state that they have unsolicited testimonials favorable to the box received from prominent railroad men.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

High Grade Electro-Magnets seem to be in great demand. The Varley Duplex Magnet Company, of 138 Seventh street, Jersey City, N. J., are said to be crowded with orders. This certainly speaks well for the quality of goods this firm is turning out.

INCORPORATIONS.

The Harvey Lake Electric Light, Heat & Power Company, Wilkes-Barre, Pa. Capital stock \$1,000.

The Nescopeck Electric Light Company, Nescopeck, Luzerne County, Pa. Capital stock, \$5,000.

The Tiffin, Fostoria & Eastern Electric Railway Company, Tiffin, O. Capital stock, \$175,000.

The Hampton & Amesbury Street Railway Company, Hampton, N. H.—to build and operate an electric railway from the village of Hampton, through Hampton Falls to the State line in Seabrook. Capital stock, 75,000.

The Jamestown Electric Light & Power Company, Jamestown, Cal. Capital stock, \$50,000. Incorporators: William A. Neville, John Ballard, W. H. Martin, W. Grant and R. B. Carpenter.

The Minneapolis & Anoka Electric Suburban Railway Company, Anoka, Minn. Capital stock, \$70,000. Incorporators: Henry Lee, I. A. Caswell, A. E. Giddings, Theodore Coleman, John Coleman, John Dunn, Hiram Thornton, O. L. Cutter and Frank Hart, all of Anoka.

The Wappler Electric Controller Company of Manhattan, Capital stock, \$3,000. Directors: R. Wappler, J. C. F. Jacoby, F. H. Wappler and Charles Foyer.

The New Kensington Street Railway Company of Westmoreland County, Pa. Capital stock, \$12,000. Incorporators: T. A. Mellon, Jr., W. L. Mellon, F. M. Ross, O. T. Marsh, W. S. Mitchell of Pittsburgh.

The Westfield Realty & Construction Company, a branch of the Midland Railroad Company, Richmond, Staten Island, N. Y.—to erect dwellings, factories, power houses, car barns, docks, railways, tramways and electric railroads. Capital stock, \$50,000, with \$100,000 subscribed. Incorporators: W. B. Rockwell, M. J. Wightman, J. C. Hitchcock, F. E. Bradley, C. M. Robinson, C. O. Ellis and M. C. Quimby.

The Queens Borough Electric Light & Power Company, Far Rockaway, N. Y.—to operate in Kings, Queens and Suffolk counties Capital stock, \$250,000. Directors: Van Wyck Roselle, D. H. Valentine, Royal C. Peahody, C. L. Rosier, T. S. Williams of Brooklyn, Frank McGovern of New York City, Joseph O. Biglin of Far Rockaway, I. M. Sutton of Flushing and H. Hobart Porter, Jr., of Lawrence.

The Ewing Passenger Railway Company—to operate a street railway in Ewing township, N. J.—has filed a certificate of incorporation with the Secretary of State at Trenton. Capital stock, \$12,500. Incorporators: Henry C. Moore, R. S. Woodruff, B. Frank Abbott, Peter E. Hurley, J. H. Solomon, W. S. Gulick and F. P. Nippers.

The Huguenot Electric Street Railroad Company of Westchester County, New York City—to build and operate a belt street railway about 11 miles long having its terminus in New Rochelle. Capital stock, \$110,000. Directors: Louis K. Fries, Jacob M. Schuyler, James H. Burchell, Nathaniel J. Burchell, New Rochelle; George G. Dwyer, D. W. Webster, William H. Miller, John A. Cass, A. B. Linderman, Frank E. Wiggins, John A. Van Rensselaer, Ephraim Miller, M. B. Faulkner, George C. Reuwer and E. R. Brevoort.

The Bolton Falls Electric Company, Bolton Falls, Vt.—to erect a plant to supply Waterbury with electricity for power and lighting. Capital stock, \$75,000. Incorporators: George H. Almon of Montpelier, C. I. McMahon of Stowe, G. E. Moody, F. W. Randall, C. C. Warren and C. D. Robinson of Waterbury, Vt.

The Robertson Pneumatic Electric Transmitting Company, Aberdeen, Ia.—Capital stock, \$5,000,000. Incorporators: A. J. Robertson, C. T. Carr, Chicago; C. T. Easton, Aberdeen.

The Greenbrier Valley Construction Company, Grafton, W. Va.—to construct railroads, telegraph and telephone lines, etc. Capital stock, \$2,000,000. Incorporators: Hon. John T. McGraw of Grafton; J. M. Beckley, E. M. Upton and Thomas R. Lewis of Rochester, N. Y., and Charles M. Warner of Syracuse, N. Y.

The Standard Electric Company, Binghamton, N. Y.—to purchase, sell and install electrical and mechanical devices and appliances and to engage in mechanical engineering and construction. Capital stock, \$5,000. Directors: C. F. Terhune, L. M. Blanding and R. E. Prince.

The Manaois Railway Company filed articles of incorporation at Albany, N. Y., on the 25th ult. the purpose of the company being to construct and operate a steam or electric railroad line in the city of Manaois and elsewhere in the State of Amazonas, Brazil. Capital stock, \$500,000. Directors: A. J. Maham, Lorain, Ohio; M. N. Brady of Albany; E. O. Mayham, O. R. Flint, W. D. Walker and E. O. Converse of New York City; J. W. Scott of Orange, N. J.; F. R. Stewart of Brooklyn, and F. H. Hebblethwaite of Manaois, Brazil.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 1, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

599,766. Insulated Railway Joint. Peter Clark, Philadelphia, Pa. Filed May 21, 1897.

599,763. Rheostat. Sidney H. Short, Cleveland, O. Filed May 14, 1897.

599,807. Pneumatic Controlling Mechanism for Electric Railway Cars. Sidney H. Short, Cleveland, O. Filed Nov. 18, 1897.

599,828. Electric Railway. William M. Brown, Johnson, Pa., assignor to the Johnson Company, Lorain, O. Filed Oct. 7, 1897.

599,868. Electric-Car Trolley. William H. Russell, Newcastle, Canada. Filed April 18, 1896.

600,009. Third Rail. Lowell M. Maxham, Boston, Mass. Filed June 7, 1897.

600,101. Supply System for Electric Railways. David Urquhart and Frank Wynne, London, England. Filed Feb. 25, 1897.

599,770. Car Fender. Francis S. Davidge, Washington, D. C. Filed April 19, 1894.

599,920. Fender for Trolley-Cars. Otto Spreckenbach, New York City, assignor of one-half to August Trieb, same place. Filed Oct. 11, 1897.

600,099. Car Fender. Jakob W. Musman, New York City, assignor of one-half to Benjamin Bokey, same place. Filed Nov. 26, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 599,742. Apparatus for Visible Signaling. Leopold Seller, Vienna, Austria-Hungary. Filed March 28, 1896.
 599,819. Electric-Arc Lamp. Ernest P. Warner and Henry H. Wait, Chicago, Ill., assignors to the Western Electric Company, same place. Filed March 16, 1897.
 599,880. Electric-Arc Lamp. Christian Tepel, Bennett, Pa. Filed Dec. 31, 1896. Renewed Jan. 27, 1898.
 599,910. Incandescent Electric Lamp. John T. Lister, Cleveland, O. Filed Oct. 2, 1897.
 599,931. Electric-Arc Lamp. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkensburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Aug. 22, 1896.
 599,975. Portable Electric Lamp. Leonard Paget, New York City, assignor to David S. Ferris. Filed July 8, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 599,692. Electric Switch. George Doyle, Brookline, Mass. Filed Aug. 11, 1896.
 599,781. Current-Collecting Device. Ludwig Gutmann, Peoria, Ill. Filed April 26, 1897.
 599,784. Transformation of Alternating Currents into Direct Currents. Adolph Muller, Hagen, Germany. Filed July 30, 1897.
 599,791. Electric Motor. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Filed Oct. 17, 1896.
 599,801. Method of and Means for Controlling Electric Motors. Sidney H. Short, Cleveland, O. Filed May 19, 1897.
 599,805. Method of and Means for Controlling Electric Motors. Sidney H. Short, Cleveland, O. Original application filed May 19, 1897. Divided and this application filed Oct. 21, 1897.
 599,810. Alternating-Current Motor. William Stanley, Pittsfield, Mass., assignor to the General Electric Company of New York. Filed May 9, 1896. Renewed Nov. 17, 1897.
 599,815. Variopolar Motor or Dynamo. Henry H. Wait, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Aug. 20, 1896. Renewed July 29, 1897.
 599,892. Electric Regulator for Dynamos. William H. Chapman, Portland, Me., assignor to the Belknap Motor Company, same place. Filed Feb. 10, 1897.
 599,913. Electric Motor. Edmund McNeerney, Pittsfield, Mass. Filed May 22, 1897.
 599,918. Motor-Casing. Sidney H. Short, Cleveland, O. Filed Feb. 16, 1897.
 599,929. Quick-Break Switch. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed July 22, 1897.
 599,940. Switch for Electric Circuits. Harry P. Davis, Pittsburg, and Ernest F. Harder, Wilkensburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Filed Oct. 28, 1896.
 599,932. Method of and Apparatus for Regulating Electric Motors. Budd Frankensfield and Dugald C. Jackson, Madison, Wis. Filed Jan. 28, 1897.
 599,910. Non-Synchronous Electric Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed April 30, 1897.
 599,941. Direct-Current Electrical Machine. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Original application filed May 8, 1896. Divided and this application filed July 8, 1897.
 599,942. Inductor-Dynamo. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed July 12, 1897.
 599,943. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Sept. 18, 1897.
 599,944. Switch for Electric Circuits. Gilbert Wright, Wilkensburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Sept. 18, 1897.
 600,088. Current-Collector for Dynamo-Electric Machines. George W. Nell, Philadelphia, Pa. Filed Feb. 23, 1897.
 600,092. Electrically-Operated Hoisting Machinery. Anton J. Shaw, Muskegon, Mich., assignor to the Shaw Electric Crane Company, same place. Original application filed May 6, 1893. Divided and this application filed Jan. 16, 1894.
 600,112. Electric Switch. James J. Flint, Denver, Col., assignor to Flint & Lomax, same place. Filed Feb. 16, 1897.

ELECTRIC HEATERS, ETC.

- 600,057. Rheostat and Electric Heater. Henry P. Ball, Brooklyn, N. Y., assignor to the Ward Leonard Electric Company, Bronxville, N. Y. Filed Oct. 30, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 599,801. Toll-Collecting Device for Telephones. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 20, 1896.
 599,867. Telephone-Transmitter. James H. Rogers, Bladensburg, Md. Filed March 9, 1897.
 600,073. Telegraph-Table. John J. Hall, Slough, England, assignor to George Wilson Dawes, London, England. Filed Oct. 4, 1897.

MISCELLANEOUS.

- 599,718. Plate for Accumulators. Wilhelm Majert, Grunau, Germany. Filed Aug. 19, 1897.
 599,800. Automatic Electric Door-Closer. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 3, 1896.
 599,862. Electrically-Propelled Vessel. Daniel O'Flaherty, Kansas City, Mo. Filed May 12, 1897.
 599,881. Magnetic Closer. Joseph N. Thomas, Johnstown, Pa., assignor to the Johnson Company, Lorain, Ohio. Filed Oct. 19, 1897.
 599,891. Electric Contact Device. John L. Buchanan, Johnstown, Pa., assignor to the Steel Motor Company, same place. Filed Feb. 4, 1897.
 599,947. Electrically-Propelled Vehicle. Philip R. Salberg, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Feb. 5, 1896.
 600,038. Flexible Electric Conductor. Antoine Bournonville, Philadelphia, Pa. Filed Nov. 20, 1897.

DESIGN.

- 23,327. Electric-Heater Case. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Nov. 2, 1895.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

TELEPHONE AND TELEGRAPH.

A Telephone Measure in the Iowa Legislature.

A telephone bill in the interest of independent companies has been introduced in the Iowa Legislature. The full text of the bill is as follows:

Section 1. That all telephone companies, or persons owning and operating any telephone exchange, or telephone line, for hire within this State, shall, at all points where such telephone lines enter or reach cities and towns within this State, where a local telephone exchange is maintained and operated, or where another telephone line or system is maintained and operated, arrange for and establish means of proper connection and communication with such local exchange or other telephone lines, and shall on request of any person without unreasonable delay, and without any additional charge therefor, furnish and make proper connection for communication by such person with any of the lines of said local exchange, or the lines of such other telephone system; provided, however, that this act shall not prohibit the collection of the regular charge for transmission of messages of communication over such telephone line or connecting line.

Sec. 3. Any telephone company or persons, owning and operating any telephone line or local telephone exchange, who shall refuse or fail to arrange for and grant connection and communication with a local telephone exchange, or other telephone line, as required in the preceding section, shall be subject to a penalty of fifty dollars for each failure or refusal, which penalty may be recovered by an action brought before any justice of the peace in the county where such failure or refusal is made, in the name of the State of Iowa and for the use and benefit of the school fund thereof.

It is said of Dennis Doren, general superintendent of construction of the Western Union Telegraph Company, who died recently at Norwalk, O., that when, during the civil war, Superintendent Eckert took charge of the military telegraph of the Department of the Potomac and put him in charge of the construction corps, he frequently put up a line and had it in working order as soon as military headquarters could be moved. He laid the cable from Cape Charles to Fortress Monroe, and the first message over it was the news that the Monitor had crippled the Merrimack. Mr. Doren was credited with having built and taken down on an average twenty-four miles of wire daily for the last two years of the war. He kept all corps headquarters in constant connection with the headquarters of Generals Grant and Meade. In July, 1866, his services were rewarded by the presentation to him of one of the twelve watches given by the Government to men who had performed meritorious and valuable service.

At the meeting of the directors of the Central West Virginia Telephone Association held at Clarksburg on February 26 reports were read showing a phenomenal growth of exchanges. The system now reaches half the counties in the State, and is expected to reach nearly every county by the close of the year. A vigorous fight is being made against the Bell Company in many parts of the State. The directors elected officers as follows: President, P. J. Grophs, West Union; vice president, Dr. S. H. Yost, Fairmount; treasurer, J. R. Alexander, Clarksburg.

Mr. Carroll's bill in the New Jersey Legislature compelling electric light companies to use red insulators where electric light wires are strung on the same poles with telephone or telegraph wires was reported adversely by the Revision of Laws Committee. When the bill was returned to the House a motion was made to have the House concur in this report, but an amendment to non-concur, offered by Mr. Carroll, prevailed and the bill went on the calendar for a second reading. The object of the bill is to prevent accidents to telegraph and telephone linemen who, while repairing wires, could tell at a glance which were the dangerous wires if red insulators were used.

Manager Huber of the Citizens' Telephone Company, Vicksburg, Miss., reports that his company is progressing most satisfactorily. A number of obstacles were encountered in Vicksburg, but they have all been overcome, and the company is now in such position that it can go on with its work without any interruption. The new subscribers are being put in at the rate of five a day, and it is expected that the capacity will be largely increased in the near future.

The Minneapolis city council has passed an ordinance granting to the Mississippi Valley Telephone Company permission to build a plant and operate a general telephone exchange in Minneapolis. According to the ordinance, the new company must use the metallic circuit through the entire city, and the limit for business telephones is \$48 a year and for residence telephones \$30 a year.

The Interstate Telephone Company is extending its lines in Kansas. Lines will be built connecting St. Joseph, Mo., with Wathena, Troy, Hiawatha, Pierce Junction and

Marysville. The system when completed in Kansas and Nebraska will embrace about 2,000 miles. As soon as the lines west of the Missouri river are in working order, the work of stringing wires to St. Louis will begin.

S. G. Higgins, president of the Saginaw Valley Telephone Company, has, it is understood, entered into an agreement with P. Cooper Burns, president of the American Electrical Company of Grand Rapids, Mich., to connect the Saginaw Valley and Grand Rapids independent telephone systems. The line will be built of copper, full metallic, by way of Howard City, Edmore and Alma, and work will begin at an early date.

In the Virginia Legislature when the Senate bill which imposes a transmitter tax of \$1.50 each on telephone companies who have more than 2,000 telephones was presented, Mr. Saunders offered as an amendment that the tax be made \$2.50 for each transmitter of companies having over 4,000 telephones. The amendment was agreed to and the bill was passed.

The Bell Telephone Company's instrument statement for the month ended February 20 shows: Gross output, 23,897; returned, 12,790; net output, 13,107. For the same month in 1897 the gross output was 19,680; returned, 8,015; net output, 11,665. A noteworthy feature of the February statement for 1898 is the large number of instruments returned, 12,790, which stands as a record.

At the meeting of the Merchants & Manufacturers' Board of Trade, held in New York last week, resolutions were passed condemning the high telephone rates in New York, and a committee was appointed, composed of leading members of the board, to visit Albany and endeavor to convince the Senate Finance Committee that they should recommend for passage the bill now in their hands providing for lower rates.

Superintendent John D. Easterling of the Southern Bell Telephone Company at Mobile, in recognition of the fidelity shown by the employees during the recent fever visitation, sent a substantial check to each of them, enclosed in a letter thanking them for their faithfulness and care of the company's interests during the epidemic.

The Telephone Subscribers' Association of Washington, D. C., which originated in the movement to obtain cheaper telephone rates, has been made a permanent organization. W. W. Danenhower is the treasurer.

The Snake River Valley Telephone Company has been granted a franchise at Idaho Falls, Idaho. The company has wires strung from Market Lake to St. Anthony and Menan now, and is extending its line to the Falls. It will also extend its line to Lost River points.

Upon the petition of J. E. Keelyn, Judge Simonton has signed an order for the foreclosure of the Carolina Mutual Telephone Company of Charleston, S. C., and appointed Major George H. Edwards receiver. A Charleston dispatch states that the company will be reorganized.

The city council of Owosso, Mich., has granted a franchise to the Owosso Telephone Company with the understanding that the company must have fifty telephones in operation by September 1.

The Citizens' Telephone Company of Newport News, Va., is pushing work on its line and will in a few days have connections with Hampton, Phoebus, Old Point and Norfolk.

The Michigan Telephone Company has canvassers out at Bay City soliciting new subscribers at the \$12 a year rate. All contracts are made for one year.

A new telephone line will shortly be introduced at Muscatine, Ia., by the Mississippi Valley Telephone Company.

New Companies Incorporated.

The Interstate Telephone Company of Sioux Falls, Sioux Falls, S. D. Capital stock, \$10,000,000. Incorporators: Charles O. Bailey, John H. Voorhees and J. W. Carter.

The Southwestern Telegraph & Telephone Company, Santa Fe, N. M.—to put in a telegraph and telephone line from Santa Fe via Cerillos and Thornton to Bland in the Cochiti district. Capital stock, \$10,000. Incorporators: W. N. Townsend, manager of the Postal Telegraph office at Santa Fe, J. P. Connor and H. A. D. Purdy.

The Enfield Telephone Company, Enfield, Me.—to carry on a telephone business. Capital stock, \$2,000. President, Samuel W. Bragg; treasurer, Michael S. Fahey; clerk, Herbert W. Lord.

The Western Telephone Company, Goodland, Marion County, Ind. Capital stock, \$30,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g. gold, guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mlg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Mar. 7:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1½ % Q., Aug. '97.	133½	181½
Troy City Railway Co.	100	2,000,000	2,000,000	1½ % Q., Sept. 10, '97.	72	72
Traction Co. (Saratoga)	100	50,000	50,000	.....	.....	.....
Allentown, Pa.—Mar. 7:						
Allentown & Lehigh Val. Trac. Co.	.....	4,000,000	1,500,000	.....	80	80
Bridgeport, Conn.—Mar. 7:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60
Baltimore, Md.—Mar. 7:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	72	78
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98	23½	24
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A., 1897.	80	82½
Boston, Mass.—Mar. 7:						
New England Street Ry.	25	5,000,000	1,081,925	1½ % Q., Jan. 15, '97.	10	20
North Shore Traction Co.	100	4,000,000	4,000,000	8 % S., Oct. '96.	77	78
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	82½	83
West End Street Ry. Co.	50	10,000,000	9,085,000	1½ % S., Oct., '97.	103	104
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	57½	58
Boston Elevated R. R. Receipts	.....	.....	.....	.....	.....	.....
Brooklyn, N. Y.—Mar. 7:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,000,000	2½ % Aug. 1, 1897.	191	191
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	.....	38½	88½
Brooklyn Heights Railroad	.....	200,000	200,000	.....	200	108
Brooklyn City RR.	100	12,000,000	12,000,000	2½ % Q., July, '97.	150	180
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	.....	48	52
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % July 1, '97.	42	42
Kings County Elevated	100	4,750,000	4,750,000	.....	74	80
Kings County Traction Co.	100	4,500,000	4,500,000	1½ % July 26, '97	.....	.....
Nassau Electric Railroad	50	6,000,000	6,000,000	.....	.....	.....
Atlantic Avenue Railroad	50	2,400,000	2,000,000	.....	.....	.....
Brooklyn, B. & W. E. Railroad	.....	1,000,000	1,000,000	.....	.....	.....
Buffalo, N. Y.—Mar. 7:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	.....	62	65
Buffalo Railway Co.	100	6,000,000	5,870,500	1½ % Q., Sept., '97.	81	84
Columbus, O.—Mar. 7:						
Columbus Street Railroad	100	8,000,000	8,000,000	1½ % Q., Feb., '97.	46	48
Columbus Central Street Railroad	100	1,500,000	1,500,000	.....	.....	.....
Charleston, S. C.—Mar. 7:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	.....	.....
Enterprise City RR. Co.	25	1,000,000	250,000	.....	.....	.....
Chicago, Ill.—Mar. 7:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Sept. 15, '97.	237	237½
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	.....	12	12½
Lake Street Elevated RR.	100	10,000,000	10,000,000	.....	4	4
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	.....	222	224
Met. West Side El. const. stk.	100	15,000,000	2,500,000	.....	.....	.....
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Oct., '97.	.....	.....
North Chicago City RR.	100	500,000	249,900	.....	.....	.....
South Chicago City Railway	100	2,000,000	1,603,200	.....	95	95½
West Chicago St. RR. Co.	100	20,000,000	18,189,000	1½ % Q., May, '97.	.....	.....
Chicago West Div. Ry.	100	1,250,000	624,900	35 % S.	.....	.....
Chicago Passenger Ry.	100	2,000,000	2,000,000	5 % S.	.....	.....
Cincinnati, Ohio.—Mar. 7:						
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000	.....	20	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2½ % S., Feb., '98.	75	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000	.....	28	21
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1½ % Q., July, '97.	115½	116
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Oct., '96.	.....	.....
Cleveland, Ohio.—Mar. 7:						
Arvon, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000	.....	41	48
Cleveland City Ry.	100	8,000,000	7,600,000	¾ % Q., Oct., '97.	59	60
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	60½	61
Detroit, Mich.—Mar. 7:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	.....	100½	100
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	175
Rapid Railway Co.	.....	250,000	250,000	.....	100	100
Detroit Electric Railway	.....	1,000,000	1,000,000	.....	100	110
Wyandotte & Detroit River Ry.	100	250,000	200,000	.....	.....	.....
Dayton, O.—Mar. 7:						
City Railway Co.	100	1,500,000	1,470,600	1½ % Q., Oct. 1, '96.	100	102
City Railway Co. pfd.	100	600,000	600,000	1½ % Q., Oct. 1, '96.	140	145
People's Street Railway	.....	1,100,000	.....	.....	100	100

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Mar. 7:						
Hartford Street Ry. Co.	100	\$2,000,000	\$200,000	1 % S., July, '97.	140	140
Hartford & West Hartford RR.	100	1,000,000	247,000	.....	.....	.....
Holyoke Mass.—Mar. 7:						
Holyoke Street Ry. Co.	100	600,000	400,000	1½ % A., July, '97.	200	205
Hoboken, N. J.—Mar. 7:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	4 % S., 1897.	70	70
Indianapolis, Ind.—Mar. 7:						
Citizens' Passenger Ry.	.....	5,000,000	5,000,000	.....	25	26
Lancaster, Pa.—Mar. 7:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	.....	.....	.....
Lancaster & Col. Electric Ry.	.....	.....	87,500	.....	.....	.....
West End Street Railway	.....	.....	.....	.....	.....	.....
Louisville, Ky.—Mar. 7:						
Louisville Ry.	100	4,000,000	4,000,000	1½ % S., Apl., '97.	86	88
Louisville Ry. 5 % pfd.	100	2,000,000	2,000,000	2½ % S., Apl. 1, '97.	94	95
Minneapolis, Minn.—Mar. 7:						
Twin City Rapid Transit	100	17,000,000	15,010,000	.....	20	24
Twin City Rapid Transit 7 % pfd.	.....	8,000,000	1,187,200	1½ % S., Apl., '97.	.....	100
Montreal, Canada.—Mar. 7:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	262	264
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1½ % S., J. & J.	103½	103½
Memphis, Tenn.—Mar. 7:						
Citizens' Street Railway Co.	100	1,500,000	1,500,000	.....	15	15
New Haven, Conn.—Mar. 7:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '96.	57	60
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	.....	40	42
Winchester Avenue RR.	25	1,000,000	600,000	.....	.....	.....
New Orleans, La.—Mar. 7:						
Canal & Claiborne RR. Co.	40	240,000	240,000	2½ % S., July, '96.	140	158
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Apl., '97.	122½	124
New Orleans Traction Co.	100	5,000,000	5,000,000	.....	9	15
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	6 % S., J. & J.	.....	.....
Crescent City RR.	100	2,000,000	2,000,000	3 % S., July, '97.	82	82
New Or. City & Lake RR.	100	2,000,000	2,000,000	4 % S., July, '97.	16	21
Orleans Railroad	50	500,000	185,000	1½ % S., June, '94.	54½	55½
St. Charles Street Railway	50	1,000,000	1,000,000	1½ % S., Apl., '97.	.....	.....
New York—Mar. 7:						
Central Crostown RR.	100	600,000	600,000	2½ % Q., July, '97.	200	200
Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Apl., '97.	155	165
Dry Dock, E. Bldg'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., '97.	141	142
Metropolitan Street Ry. Co.	100	80,000,000	80,000,000	1½ % Q., July, '97.	30	35
Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	1½ % A., July, '97.	205	209
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2½ % Q., July, '97.	170	180
Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 % Q., July, '97.	820	825
Eleventh Avenue RR.	100	1,000,000	1,000,000	.....	180	180
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4½ % Q., Aug., '97	196	210
Ninth Avenue RR.	100	800,000	800,000	.....	800	825
Sixth Avenue RR.	100	2,000,000	2,000,000	4½ % Q., Aug., '97	160	165
Twenty-third St. R. E. Co. guar.	100	600,000	600,000	4½ % Q., Aug., '97	179	180
Second Avenue RR.	100	2,500,000	1,862,000	1½ % Q., Jan., '97	64½	67
Third Avenue RR.	100	12,000,000	1,862,000	2½ % Q., Aug., '97.	190	210
42d St. Manhat'le & St. Nich. Av	100	2,500,000	2,500,000	.....	.....	.....
Union (Huckleberry) Ry.	100	2,000,000	2,000,000	.....	.....	.....
Newark, N. J.—Mar. 7:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	.....	43	50
Newark Passenger Ry.	100	6,000,000	6,000,000	.....	185	193
Rapid Transit Street Ry.	100	504,000	504,000	11½ % A.	.....	.....
Pittsburg, Pa.—Mar. 7:						
Allegheny Traction Co.	50	500,000	500,000	.....	45	45
Consolidated Traction Co.	50	15,000,000	15,000,000	2 % S., Jan., '96.	14½	14½
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 % S., May, '97.	47	47½
Central Traction Co.	50	1,500,000	1,500,000	.....	6	6
Citizens' Traction Co.	50	8,000,000	3,000,000	6 % A.	.....	.....
Duquesne Traction Co.	50	3,000,000	3,000,000	.....	.....	.....
Pittsburg Traction Co.	50	2,500,000	1,900,000	3 % S., Aug., '96.	.....	.....
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ % S., July, '97.	24½	24½
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,984,880	2½ % S., Aug., '96.	19	19½
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	1½ % S., Jan., '96.	.....	.....
Pittsburg & West End Ry.	50	1,500,000	1,500,000	3 % A., June 30, '96.	.....	.....
Second Avenue Traction Co.	50	4,000,000	14,000,000	.....	.....	.....
Suburban Rapid Transit Co.	50	800,000	200,000	A.	.....	.....

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Co. and City & Suburban Ry. Co.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Pothan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Heights Company.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h 800 shares on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$200,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 88 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,500,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 2nd Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %.
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter.
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1½ % yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent. Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 8 % on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4 % on capital stock after October.
 s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.						Authorz'd	Issued.			
New Bedford Mass.—Mar. 7:							Boston, Mass.—Mar. 7:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2% Q., Oct., '97	255	257
Northampton, Mass.—Mar. 7:							New York.—Mar. 7:						
Northampton Street Ry.....	100	800,000	225,000	5% A., July, '97.	165	175	Erie Telegraph & Telephone Co.....	100	10,000,000	10,000,000	1 1/2% Q., Aug., '97.	125	69
Omaha, Neb.—Feb. 28							Commercial Cable Co.....						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	Franklin Tel. Co.....	100	1,000,000	1,000,000	2 1/2% guar.	106	106
Paterson, N. J.—Mar. 7.							Erie Telegraph & Telephone Co.....						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	4,800,000	1 1/2% Q., Aug., '97.	71	71 1/2
Providence, R. I.—Mar. 7:							*International Ocean Tel. Co. guar. 6%						
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	58	61	Mexican Telephone Co.....	100	8,000,000	.....	1 1/2% Q.	107 1/2	110
Philadelphia.—Mar. 7:							*New York & New Jersey Tel. Co.						
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000	2,000,000	.....	14 1/2	..	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	8,728,000	1 1/2% Q., July, '97.	150 1/2	151
Hestonville, Man. & Fairmount....	50	1,966,100	11,966,100	2 1/2% July 15, '97.	44	45	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 1/2% Q.	71	76
Hest'n'v'e, Man. & Fairm't. 6% pfd.	50	538,900	1533,900	3 1/2% July 15, '97.	61	65	*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2 1/2% S.	90	96
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 1/2% Feb. 1, '97.	63	66	*Commercial Union Telegraph Co.	25	500,000	500,000	8 1/2% S., July 1 '97.	111 1/2	118
aFairmount Pk. & Had. Pass. Ry.	50	30,000,000	5,986,095	.....	15 1/2	15 1/2	Western Union Telegraph Co.....	100	97,870,000	97,870,000	1 1/2% Q., Oct., '97.	86	86 1/2
Union Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	Miscellaneous.—Mar. 7:						
aElectric Traction Co.....	50	500,000	192,500	\$3 share Q.	30 1/2	...	American Dist. Tel. (Phila.).....	25	400,000	.....	.....	14	...
aCitizens' Passenger Ry.....	50	1,000,000	1,875,000	\$14 share A—Apr. 97	390	...	Bell Tel. Co. (of Canada).....	100	8,168,000	8,168,000	2 1/2% S.	174 1/2	175
aFrankford & Southwark Pas. R.	50	1,000,000	.....	.....	47	...	Chesapeake & Potomac Tel. Co.	100	.....	.....	.....	61	65
fLehigh Avenue Ry. Co.....	25	1,000,000	1,000,000	A. & O.	89	90 1/2	Chicago Telephone Co.....	100	750,000	750,000	.....	202	...
fLombard & South Street Ry.....	50	1,060,000	771,076	\$9 share A, Mar. 97	265	...	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	2,000,000	2,000,000	1 1/2% Q.	72	78
hSecond & Third Streets Ry.....	50	10,000,000	1,600,000	3% A., April, '97.	135	...	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1 1/2% Q.	74 1/2	80
iPeople's Traction Co.....	50	1,500,000	1572,800	\$5.25 share—1897.	135	...	Hudson River Telephone Co.....	100	2,500,000	2,500,000	2 1/2% Q.	112	115
jGermantown Passenger Ry.....	50	500,000	150,000	3% July, 1897.	132	...	Providence (R. I.) Tel. Co.....	50	.....	.....	.....	87 1/2	...
jGreen & Coates Passenger Ry.	25	1,500,000	1740,000	.....	...	...	Southern New Eng. Tel. Co.....	100	8,000,000	.....	.....	120	122
kPeople's Passenger Ry.....com.	25	750,000	1277,402	.....	...	...	ELECTRIC LIGHT AND ELECTRICAL MFG. COS.						
kPeople's Passenger Ry.....pfd.	25	750,000	1277,402	.....	...	...	Boston, Mass.—Mar. 7:						
lPhiladelphia Traction Co.....	50	30,000,000	120,000,000	4% S—Apr. 1, '97.	81 1/2	81 1/2	Fort Wayne Electric Co.....	25	.....	.....	.....	...	...
oCatherine & Balunbridge St.	50	1,000,000	400,000	6% A—Mar., '97.	185	145	Ft. Wayne Elec. Co. T. Sec. Series A.	100	40,000,000	30,460,000	2 1/2% Q., Aug., 1898.	81 1/2	81 1/2
pContinental Pass. Ry.....guar.	50	1,000,000	540,000	\$6 share—July, '97.	185	145	General Electric Co.....com.	100	10,000,000	4,252,000	8 1/2% S., July, '98.	96	...
qEmpire Passenger Ry. Co.....	50	600,000	600,000	.....	...	...	General Electric Co.....pfd.	100	10,000,000	4,252,000	8 1/2% S., July, '98.	96	...
rPhiladelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180	T. H. Elec. Co. T. Secur. Series D.	100	1,000,000	1,000,000	.....	41	...
sPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	\$3.50 share July '97	86	...	Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	3,998,053	1 1/2% Q., Feb., '98.	51	54
tRidge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share, July '97	262	...	Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	...	...
uPhiladelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	...	...	New York.—Mar. 7:						
v17th & 19th Sts. Pass. Ry. guar.	50	.....	250,000	1 1/2% S., July, '97.	157 1/2	...	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	188	183 1/2
wThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	135,000	\$11 sh. A., July, '97	270	...	*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2% Q., Oct., '97.	107	108
xUnion Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 shre, July '97	227	228	Edison Ore Milling Co.....	100	.....	.....	.....	...	...
yWest Philadelphia Pass. Ry.....	50	750,000	750,000	\$10 share, July '97	225	235	Edison Electric Storage Co.....	100	.....	.....	.....	...	...
Rochester, N. Y.—Mar. 7:							General Electric Co.....com.						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18	General Electric Co.....pfd.	100	40,000,000	30,460,000	2 1/2% Q., Aug., 1898.	81 1/2	81 1/2
Reading, Pa.—Mar. 7:							Interior Conduit & Insulation Co.						
Reading Traction Co.....	100	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	...	United Elec. Lt. & Pow. Co.....pfd	100	1,000,000	1,000,000	.....	...	...
kCity Passenger Ry.....	50	850,000	850,000	July, '97.	111	...	Pittsburg, Pa.—Mar. 7:						
lEast Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	64	...	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	...
St. Louis Mo.—Mar. 7:							East End Electric Light Co.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...	50	800,000	800,000	Q	10	...	
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1898.	...	...	Philadelphia, Pa.—Mar. 7:						
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% July, '97.	124	126	Edison Electric Light Co.....	100	2,000,000	.....	144 1/2	...	
National Railway Co.....	100	2,500,000	2,479,000	1 1/2% July, '97.	...	...	*Electric Storage Battery Co. com.	100	8,500,000	.....	19	50	
Case Avenue & Fair Grounds....	100	2,500,000	2,500,000	.....	...	...	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	21	22	
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110	*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	32	22 1/2
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% July, '97.	95	105	*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000	.....	6% Oct., '97.	87	58 1/2
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% July, '97.	170	172 1/2	Northern Elec. Light & Power Co.	10	6,500,000	550,000	\$2.50 dis. Jan. 11 '97	18 1/2	14
People's RR. Co.....	50	1,000,000	300,000	50c., Dec., '89.	50	52 1/2	Southern Elec. Light & Power Co..	10	187,500	187,500	.....	10	...
Southern Electric Ry.....com.	100	1,000,000	1,000,000	3% S., Jan., '96.	100	102 1/2	Miscellaneous.—Mar. 7:						
Southern Electric Ry.....6% pref.	100	1,000,000	1,000,000	.....	51	53	Brush Electric Co.....	50	.....	.....	.....	...	...
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	...	...	Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	82 1/2	88	
Union Depot RR.....	100	4,000,000	4,000,000	8% A., July, '96.	175	...	Edison Ill'g Co. (St. Louis).....	100	.....	.....	.....	15	...
San Francisco, Cal.—Mar.							Eddy Electric Mfg. Co.....						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	107 1/2	109	Hartford (Conn.) Elec. Light Co....	100	850,000	.....	118	125	
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	Hartford (Conn.) Lt. & Power Co.	25	175,000	.....	4 1/2	10	
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	531 1/2	...	New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	148	...	
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	...	...	Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	2 1/2% Q., Oct., '96.	82 1/2	85
Scranton, Pa.—Mar. 7:							Rhode Island Elec. Protec. Co.....						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12	Royal Elec. Co. (Montreal).....	100	1,000,000	.....	2 1/2% Q.	114	118
mScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	...	Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1 1/2% Q.	135	137
nScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11	Thomson-Houston Welding Co.....	100	.....	.....	3% S., Dec. 1, '96.	90	100
Springfield Ill.—Mar. 7							Woonsocket (R. I.) Electric Co.....						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	11	...	100	.....	.....	.....	...	...
Springfield O.—Mar. 7:							ALLIED INDUSTRIES.						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	2	...	Boston Mass.—Mar. 7:						
Springfield, Mass.—Mar. 7:							American Electric Heating Co.....						
Springfield Street Ry.....	100	1,200,000	1,000,000	8% A.	205	210	Street Ry. & Ill'g Properties...pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '97	...	...
Toronto Canada.—Mar. 7:							United Electric Securities Co...pfd.						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	103 1/2	10 3/4	50	.....	.....	.....	8 1/2% Feb., '96.	80	85
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 1/2% S.	262	264	New York.—Mar. 7:						
Washington, D. C.—Mar. 7:							Consolidated Electric Storage Co...						
Belt Ry. Co.....</													

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Mar. 7, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	J. & J.	*111	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1980	M. & N.	*111	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*117 ¹ / ₂	.....
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*115	.....
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*105	108
Troy City Railway Co. 1st 5s	.....	.....	.....	.....
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.						
Date of Quotation—Mar. 7, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Extens. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	104	107
Bal. Trac. Co. No. Balto. div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	116	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	112	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	112	.....
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	.....
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119½	121
* \$151,000 in escrow to retire 1st mtg. bds.						

Boston, Mass.						
Date of Quotation—Mar. 7, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	162	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	.....
* \$1,074,000 in escrow to retire outstanding bonds of absorbed companies.						

Charleston S. C.						
Date of Quotation—Mar. 7, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
* Controlled by Charleston St. Ry. Co.						

Chicago Ill.						
Date of Quotation—Mar. 7, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	103½	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	.....	55
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	52
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	101½	.....
North Chicago St. RR. Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103½	.....
West Chicago St. RR. 1st mtg. 5s.	2,700,000	8,969,000	1928	M. & N.	101½	105½
West Chicago St. RR. Deben. 6s.	12,500,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR. Cons. mtg. 5s.	1,500,000	6,000,000	1936	.....	94½	91½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101½	.....
* Redeemable at option on 60 da. notice. * Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. * Subject to call after Oct. 1, 1899, at \$110 and interest. * Assumed by W. Chl. RR. Co., lessee. * Int. guar. by W. Chicago St. RR. Co.						

Cincinnati, O.						
Date of Quotation—Mar. 7, 1898.						
Cin. New & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
* Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
* Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
* Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126½	.....
* Assumed by the Cincln. St. Ry. Co. * \$250,000 reserved to retire 1st mtg. bds.						

Cleveland, O.						
Date of Quotation—Mar. 7, 1898.						
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	101	105
Columbus (O.) Cent. Ry. 1st mtg. 5s.	1,500,000	1,500,000	1913	M. & N.	106½	107½
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & N.	90	95
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 5s.	600,000	.....	1922	J. & J.	100	102
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co. Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....
* \$1,500,000 in escrow to retire bonds of absorbed companies, marked a. * Interest guar. by Cons. St. Ry. Co.						

Detroit, Mich.						
Date of Quotation—Mar. 7, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,825,000	1905	A. & O.	.....	99
Fl. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	1902	A. & O.	.....	99½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	98½	99½
* \$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						

New Haven, Conn.						
Date of Quotation—Mar. 7, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	104	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	104	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	103	.....
* With interest.						

New Orleans La.						
Date of Quotation—Feb. 28, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	72½	.....
New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1903	J. & D.	104	110
N. Or. City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	108	.....
Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	91½	99
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	108	.....
* \$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. * \$90,000 outstanding.						

New York.						
Date of Quotation—Mar. 7, 1898.						
Atlantic Ave. (Brooklyn).... Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	90
Atlantic Av. (Brooklyn) .1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	108	109½
Atlantic Av. (Brooklyn) . Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	*108	.....
Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105½	108
Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112
Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	.....
Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	115	115½
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	116
Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	90
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	.....
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	107	108
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	.....	80
Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	91½	.....
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	105	108
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crostown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	101	105
2d Dock, E. Bd'y & Bat'y RR. 1st mtg. 5s.	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR. scrip 5%	1,100,000	1,100,000	1914	F. & A.	97	*101
Eighth Av. RR. Co. Cert. indebt. 6%	1,000,000	1,000,000	1914	F. & A.	100	.....
12d St., Man. & St. N. ch. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	118
12d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96
Lex. Av. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	.....
Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1997	F. & A.	111½	.....
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	101	105
Steinway Ry. (L. I.). 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. 5s.	850,000	850,000	1919	.....	102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	.....	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	104
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
* \$1,035,000 in escrow to retire gen. mtg. bonds.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Mar. 7, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 6s.	400,000	400,000	1906	M. & N.	101	103
Lindell Ry. Co.....1st mtg. 6s.	1,500,000	1,500,000	1911	F. & A.	105½	107½
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	111	112
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. odr.						
San Francisco Cal.						
Date of Quotation—Mar., 1898						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	.....
Geary St., Park & Ocean RR. 1st mtg. 6s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	128	129½
†Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
†Park & Cliff House RR.....1st mtg. 6s.	850,000	350,000	1912	J. & J.	109	109½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	123
†Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Mar. 7, 1898.						
Belt Ry. Co.....O. s. mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	.....
Eckington & Soldiers' Home Ry.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Mar. 7, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,548,000	1931	F. & A.	109	110
†Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	70	75
†Croestown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry. 1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	91½	98
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	108
†Croestown St. Ry. (Colu., O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	93	97
Denver Con. Tram. Ry. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	98	97
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	113	113½
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	92	94
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	500,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	489,000	1902	F. & A.	118	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
†Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	96	99
St. Paul City Ry.....1st cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	86	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$900,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Mar. 7, 1898						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	101½	.....
Pittsburg, Pa.						
Date of Quotation—Mar. 7, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Mar. 7, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,812,000	1910	.....	111½	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,116,000	1938	.....	116	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia).....	2,000,000	.....	.....	.....	108	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.).....	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Mar. 7, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 1st mtg. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	108½	.....
Chesapeake & Potomac Teleph. Co. 1st mtg. 5s.	.....	.....	.....	.....	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Mar. 7, 1898.						
American Electric Heating.....5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 5s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 1st mtg. 5s.	.....	.....	1902	J. & J.	98	100
Corporation Mfg. Co. 1st mtg. 5s.	.....	.....	1904	M. & S.	.....	.....
Washington Pump Co. 1st mtg. 5s.	75,000	.....	.....	.....	.....	.....
†Dallies						
†Memphis						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11¾c.; Lake, 12c.; casting, 11½@11¾c.

The foreclosure sale of the Inclined Plane Railway at Cincinnati is advertised to take place April 14.

The gross receipts of the Hartford Street Railway Company of Hartford, Conn., within the city limits, for the year ending December 31, 1897, was \$406,525.83.

The Park City Railway of Bowling Green, Ky., was sold under foreclosure February 28 and purchased for \$23,350 by the Fidelity Safety Vault & Trust Company of Louisville, the mortgage trustee.

A fire in the "South" exchange of the New York & New Jersey Telephone Company, 559 Fifth avenue, Brooklyn, N. Y., on the night of the 4th inst., damaged the telephone property to the amount of \$5,000.

Matthew Bolles, who died at Boston on the night of the 1st inst., was the oldest member of the Boston Stock Exchange, and was until his death the last surviving charter member of the Exchange, which was founded in 1834.

The New York Senate Committee on Miscellaneous Corporations has agreed to report favorably Senator Lamy's bill requiring gas and electric lighting companies to pay interest on sums deposited with them by consumers.

The Chicago City Railway Company has mapped out changes, extensions and improvements of its system for the present year to cost \$2,900,000. The cable system will be abandoned for an underground electric system costing \$1,000,000.

The Boston & Albany Railroad Company as an experiment has lighted some of its cars with electricity, the system used being that of the American Railway Electric Light Company. The B. & A. Railroad is the first New England road to experiment with the new system.

Attorney-General Knowlton, at Boston, has rendered a decision against the Pipe Line Gas Company, which in effect declares that the \$1,000,000 stock issued by the company is illegal because it was not authorized by the Board of Gas and Electric Light Commissioners in accordance with the provisions of the statutes.

The New York "News Bureau" has increased its dimensions about one-third and made several typographical improvements in its columns. The ugly yellow paper on which it was printed has also been superseded by a handsome drab-colored paper very pleasing to the eye. The "Bureau" as a financial newspaper has made itself a necessity in Wall Street circles.

The Pittsfield Electric Company of Pittsfield, Mass., held a special meeting recently and voted to increase the capital stock from \$100,000 to \$125,000, and to increase the bonded indebtedness from \$75,000 to \$100,000, provided that leave can be obtained from the Board of Electric Light and Gas Commissioners to do so.

Application will be made in a few days to the Philadelphia Stock Exchange to list the Pennsylvania Manufacturing, Light & Power Company \$15,000,000 stock and \$15,000,000 bonds in the unlisted department. Application is also to be made shortly to list securities of the United Traction Company of Pittsburgh as follows: \$17,000,000 common stock, \$3,000,000 preferred and \$1,725,000 five per cent. bonds.

A mortgage for \$150,000 given by the Leavenworth & Lansing Railway Company to the United States Trust of Kansas City has been filed in the office of the Register of Deeds at Leavenworth, Kan. Gold bonds bearing 6 per cent. interest and falling due January 1, 1918, are to be sold to build and equip the road. A large portion of the roadbed has already been completed.

The report of the Nassau Electric Railroad, Brooklyn, N. Y., for the quarter ended December 31, 1897, filed with the Railroad Commission, shows: Gross earnings, \$430,702; operating expenses, \$260,675; net from operation, \$170,026. In 1896 the gross earnings were \$367,782; operating expenses, \$237,365; net, \$130,416. There was a deficit in 1896 of \$28,088 and a surplus in 1897 of \$4,471. The total surplus in 1897 was \$224,321.

The New York Court of Appeals has affirmed the judgment in the case of Anna C. Erickson, who obtained a verdict of \$23,000 against the Brooklyn Heights Railroad Company for the loss of her leg in a trolley accident. The judgment, with the accumulation of costs and interest, amounts to nearly \$30,000.

The Siemens & Halske Electric Company of America, Chicago, has sued for an accounting with the Wells & French Company and O. W. Meyenburg. Mr. Meyenburg was president of both companies, and it is claimed was more interested in the Wells & French Company than in the Siemens & Halske, and in the transactions between the two companies so favored the former company as to inflict an alleged loss of \$100,000 on the latter.

Roswell Miller, president of the Chicago, Milwaukee & St. Paul road, is reported to have stated that it had been decided to equip the Chicago & Evanston division of the road with an electric trolley system. This branch of the system is devoted exclusively to suburban service. It has never paid. The change in the motive power from steam to electricity is to be made with the view of reducing expenses and furnishing improved service.

The litigation in the United States Court between the Knoxville Street Railway Company and the Rapid Transit Company, together with all court costs, etc., was practically settled by a decree handed down a few days ago by Judge Clark in the case of the Union Trust Company against the Knoxville Street Railway Company. This final settlement of the litigation between these street railway companies is in anticipation of the consolidation deal, and is a step toward perfecting the title of the properties for the new purchasers.

The net income over and above all fixed charges and taxes of the Consolidated Railway Company of Baltimore for the first six months of consolidation, as given in the treasurer's report read at the recent annual meeting, was \$328,888.20, against \$287,718.37, the income of the separate companies for the same time in 1896. The stockholders passed a resolution commending the directors for their good business management of the company.

The running of trolley cars across the Brooklyn Bridge at a toll of five cents a car, it has been discovered, has reduced the revenues of the Bridge so materially that the structure will no longer be self-supporting, and a portion of the running expenses will have to be paid with funds raised by taxation. At the present rate of loss it is estimated that the Bridge receipts for the year will not be more than two-thirds of the sum received last year. Commissioner Shea has prepared a report which shows that the Bridge receipts on February 22, Washington's Birthday, were \$1,526 as against \$2,711 on the corresponding day of 1897. On February 20, 1897, the receipts were \$4,220, and on February 19, 1898, they were \$2,221. These figures indicate to some extent the falling off in the receipts. As the Bridge loses the trolley companies gain.

The directors of the Commercial Cable Co. have declared the regular quarterly dividend of 12 per cent., payable April 1. Books close March 21 and reopen April 2. The report of the company for the year ending December 31 last shows net revenue, after deducting all expenses and \$11,750 for depreciation, of \$1,200,155, an increase of \$78,502 as compared with the previous year. The net revenue of the Postal Telegraph & Cable Company, which was purchased by the Commercial Cable Company on January 1, 1897, after deducting all expenses and setting aside \$60,000 for depreciation, was \$645,185, making a total for the system of \$1,845,341, out of which there has been paid interest on the first mortgage bonds and debenture stocks, dividends of 7 per cent. and a bonus of 1 per cent. on the capital stock, a total of \$1,440,000, leaving a balance of \$405,341, and making the total amount to the credit of surplus revenue, \$1,002,019.

ELECTRICITY.

Vol. XIV.

NEW YORK, MARCH 16, 1898.

No. 10.

ELECTRICITY

Published every Wednesday by the

ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.

Long Distance Telephone, 4021 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	145 146
The New England Gas & Coke Company.	
Street Railways and Municipalities.	
Electric Fish Torpedoes.	
Under the Searchlight,	146
"A 'Roast' for a Roaster,"	147
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XVI.—Organic Chemicals and Dyes. By J. B. C. Kershaw, F.I.C.,	147
Electric Projects in France,	148
Death by Electricity. By W. S. Hedley, M. D.,	149
On the Manufacture of Lamps and Other Apparatus for 200-Volt Circuits. By G. Binswanger Byng,	150
Electrical Engineering in Spain,	151
London Notes,	152
Alternate Current Motors.	
The Dublin Three-Phase System.	
Armature Model Making Competition at the Electrical and Kindred Industries Exhibition,	152
Book Reviews,	152
National Electric Light Association—June Meeting,	153
Communications,	153
The Warren Electric Company Receivership.	
Legal Notes,	154
The News,	154
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Recent Company Elections,	155
Commercial Paragraphs,	155
Incorporations,	155
Electrical Patent Record,	156
Telephone and Telegraph,	156
Electrical Securities—Stocks, Bonds, Etc.,	157
Notes for Investors,	160

EDITORIAL NOTES.

The New England Gas & Coke Company.

In an editorial in our issue of December 29, 1897, we commented at some length on the methods of the New England Gas & Coke Company as set forth by Mr. Lawson of the well-known firm of stockbrokers, Messrs. Lawson, Weidenfeld & Co., of New York and Boston.

Mr. Lawson's exposé regarding the above gas company, which appeared in several daily papers, led us to believe that the scheme attacked was another of those nefarious projects which are carried through, to the sole advantage of the arch conspirators, by means of glowing promises that could never be fulfilled.

As stated in our former editorial, the New England Gas & Coke Company got control in some way of the Boston, South Boston, Roxbury and Bay State of Massachusetts gas companies, doing over two-thirds of Boston's gas business. The Bay State Gas Company of Delaware, that controlled the Boston Gas Company, purchased the Brookline Gas Company from the Standard Oil party to end a competition that was seriously affecting their interests. The Bay State Gas Company of Delaware then caused a contract to be made whereby the Boston Gas Company agreed to purchase each year a certain amount of gas from the Brookline Gas Company to enable the latter to pay all its expenses and 10 per cent. dividend on its capital stock.

In the thirteenth annual report of the Massachusetts Gas and Electric Light Commissioners, which has recently been issued, the following statement appears:

"The board's attention has been called to a contract between the Boston Gaslight Co. and the Brookline Gaslight Co., which provides that for a term of 25 years from May 2, 1896, the Boston Co. shall buy of the Brookline Co., annually, such an amount of gas as will, together with the sales of the Brookline Co. to other customers, enable that company to pay all expenses, including expense of manufacture, depreciation, etc., interest at 5 per cent. upon Brookline bonds, 6 per cent. interest on promissory notes and other obligations then issued, 4 per cent. upon future notes or obligations and a dividend of 10 per cent. per annum upon Brookline capital stock. Price to be paid for gas \$1 per 1,000. At the time the contract was made there was no reason to doubt the ability of the Boston Co. to either manufacture all the gas needed or purchase a sufficient amount from the Bay State Gas Co. at a lower price than that named in the contract.

"The Boston Co. has purchased no gas under this contract, but upon tender by the Brookline Co. has paid at sundry times during the year ending May 1,

1897, about \$67,000. The Brookline Co. has thereby been enabled to pay from the treasury of the Boston Co., but not from its own earnings, interest on all its outstanding liabilities and 10 per cent. upon its stock. The contract in question was made at a time when the Brookline Co. had been unable to secure from its own business a fair return upon the necessary investment. The contract must be regarded as one of questionable public policy and of such a character as under most conditions might be absolutely unlawful or fraudulent, and should be abrogated."

The Bay State Gas Company of Delaware was ultimately forced into the hands of a receiver, and was obliged to turn over the management of the five local gas companies in Boston to the Standard Oil party. The understanding was that the Bay State Gas Company of Delaware had the right to take back the management of these several companies at any time it could see its way to settling. \$9,000,000 of Boston United Gas bonds, first series. The Bay State Company was on the verge of resuming the management of the various gas companies when the New England Gas & Coke Company stepped in and proceeded to negotiate with the Standard Oil party for the purchase of its Brookline and Dorchester gas companies.

In the report just issued the Commissioners review the incorporation of the Massachusetts Pipe Line Company, which represents, according to Mr. Lawson, practically nothing but a charter, its contracts with various Boston gas companies for their supply of gas, and its contract to purchase gas from the New England Gas & Coke Company. The Commissioners say:

"The knowledge of these transactions has so recently come to the board that it is difficult at this time to fully appreciate their importance. One purpose, however, would seem to be to offer to the public upwards of \$27,000,000 of new securities free from the restrictions and supervision imposed upon regularly incorporated companies engaged in a kindred business, and free particularly from the provisions of chapter 450 of the Acts of 1894, which prohibits gas companies from issuing stock or bonds except as approved by the Gas Commissioners. Attention is particularly called to these facts as constituting a notable evasion of existing laws passed for the mutual protection of the investor and consumer, with the suggestion that if any check is to be imposed upon such a course, some additional legislation will be necessary."

As could readily have been foreseen, the Commissioners recommend the abrogation of the Boston Gas Light Company's contract with the Brookline Company, and condemn the action of the Massachusetts Pipe Line Company. In this same report the Commissioners give some details relating to the operation of municipal gas and electric lighting plants which

should prove interesting to those who advocate municipal ownership. "The aggregate returns of 14 municipal gas and electric light plants show for the electric light plants as follows: Total receipts, \$52,106; expenses, \$122,261; net loss in operating, \$70,155; interest on notes and bonds, \$25,955; depreciation, \$39,777; loss on jobbing, \$273; total cost of street lighting, \$136,160. The operation of gas plants shows a net loss of \$9,839."

* * *

Street Railways and Municipalities.

A Special Commission appointed by Governor Wolcott of Massachusetts some time ago, to investigate the relations between municipalities and street railway companies, recently handed in its report, which has created considerable interest. The Commission's recommendations were made after one of its members had visited a number of European cities, and other of its members had examined carefully into the relation existing between municipalities and many of the most important street railways in this country. Like the majority of State Commission reports issued in Massachusetts, this one is exceedingly thorough and complete, the conclusions of the Commission having since been embodied in two bills for presentation to the State Legislature. The principal propositions of the Special Street Railway Commission's report are as follows:

"1. That the corporation tax now collected by the State on the excess of the share value of a company above the value of the real property be distributed to the cities and towns containing the trackage of said company in proportion to the mileage in each, instead of as now, to the localities where the stock of the company is owned or held.

"2. That where dividend payments go above 8 per cent. the street-railway companies be required to pay into the State treasury a sum equal to the excess except where a company has failed to earn an average of 6 per cent. a year from the time of its incorporation.

"3. That a franchise tax additional to that now imposed in the manner noted in the first paragraph above be levied on the gross earnings of the companies, the rate varying from 2 per cent. where gross receipts per mile of track operated shall amount to \$7,000 or less a year to 3 per cent. where such receipts amount to \$28,000 a mile or more.

"4. That cities and towns be permitted to buy in existing street railway track at the cost to replace it, and to construct new track or extensions as the public convenience may dictate, the local government thereafter to maintain the way as it maintains other parts of the streets, and to be compensated therefor by the railway company using the tracks in a sum fixed by mutual agreement or by a referee for periods of seven years."

These recommendations would seem to be excellent, if we except possibly the last. Whether any material benefit would be derived by a city's owning the street railway tracks is questionable. If these tracks are to be leased to a company for the short period of seven years, with the possibility that at the expiration of that time the lease will not be renewed except at a much higher rate, a railway company might justly show considerable hesitancy in investing a large sum of money in a power station and other suitable apparatus. Regarding this matter the Commissioners appear to have adopted a middle course and shown themselves rather conservative.

Probably the most important paragraph of the whole report is the one that refers to the number of passengers that a road would be obliged to carry in a year per mile in order to secure a return of 6 per cent. on the capital invested. This passage, which we referred to in a recent issue of *ELECTRICITY*, reads as follows:

"An intending investor in an existing or projected street railway enterprise will take into account the chances in a series of years of a management and success a little below as well as above the

general average. If he desires a regular annual return of 6 per cent. on his shares, he ought to be convinced, we think, that the railway will carry year in and year out more than 135,616 passengers per mile operated, and more than 4,014 per \$1,000 of capital investment; otherwise, the probabilities, based on the experience of 48 companies, are that he must be content with a smaller return. Unless it can be demonstrated, moreover, that the railway will carry year in and year out more than 70,895 passengers per mile operated, and more than 2,532 passengers per \$1,000 of capital investment, the chances, as proved by the experience of 28 companies, are that he will receive no dividend at all."

From some data on this subject which we happen to have on hand, we find that the Special Commission's estimate of 135,616 passengers that would have to be carried yearly per mile to earn 6 per cent. is correct, or at least agrees with our figures, provided the operating expenses of a road do not exceed 7 to 7½ cents per car mile, which however is extremely low and hardly a fair average. In localities where fuel is, say from \$3 to \$4 a ton, the operating expenses would be considerably higher, ranging in the neighborhood of from 8 to 13 cents per car mile. Taking 11 cents as a good average, according to our figures 206,000 passengers would have to be carried per mile per year to enable an electric road to earn a dividend of 6 per cent. An electric car must earn about 18 cents gross per mile to pay 6 per cent. on this investment, allowing nothing for the cost of the franchise.

Taking it all in all the report of the Massachusetts Special Railway Commission is an exceedingly able one, and the suggestions contained therein should prove valuable.

* * *

Electric Fish Torpedoes.

What is known as fish torpedoes have played an important part in modern naval contests, especially during the late struggle between Japan and China. These engines of warfare are propelled through the water by means of either compressed air or electricity. Fish, or automobile, torpedoes were especially designed for harbor protection and have now reached a high state of perfection. They can be controlled either from the shore or from a ship at anchor.

A fish torpedo when in use is entirely submerged with the exception of a float that skims the surface of the water. At either end of the float a small flag is usually located by day and an electric light by night. The lights at night are hidden from the enemy by means of a shade which permits of the lights being seen only from behind. By noting the position of the flags or lights the torpedo may be guided from the shore in any desired direction. In the after part of an electric fish torpedo is located a reel carrying three separate coils of insulated wire, one of which is attached to the motor located in the forward part of the cigar-shaped boat, a second controls the steering apparatus, while the third enables the operator on shore to fire the explosive.

Lieut. Nicholas J. Halpine, U. S. Navy, has recently invented a new form of electric fish torpedo which bears his name. In reality the Halpine torpedo is an electric launch which carries within itself sufficient power to propel it a distance of fifteen miles. The body of this craft is twenty-six feet long by twenty-four inches in diameter. It is operated from the shore by means of two cables, each of which has seven strands of wire. One cable is attached to the motor and supplies the latter with the requisite amount of current, while the second is connected with the rudder. Electrical connection being made through a switchboard, the amount of current can be varied or reversed, thus enabling the operator to propel the torpedo either ahead or astern.

The principal advantage claimed for this new form of electrical fish torpedo is that no obstacle can prevent its reaching a vessel against which it is sent.

When the harpoon-tipped point with which this

form of torpedo is provided strikes an obstacle such as a torpedo net, it is supposed to penetrate one of the meshes, the force of the blow releasing this tip and opening two flanges, which would prevent the tip being drawn out of the net. From the flanges a chain runs back to a compartment containing the torpedo. This same impact against a collar is supposed to release a car which slides forward, and at the same time a spring tears off the leaden covering on the end of the water-tight tube which runs through the can and is surrounded by the explosive. As the cover of the tube is torn off, water naturally enters and comes in contact with metallic potassium, which ignites, the flame setting off a rocket which shoots forward carrying the car containing the explosive. As the torpedo tube has a downward inclination, the torpedo is supposed to shoot downward, passing under the net, and on reaching the end of its chain move upward until it strikes the vessel.

Experience has shown that torpedoes are at times extremely unreliable, and are very apt to explode when least desired. It would therefore seem questionable whether the Halpine torpedo could be made to work satisfactorily, owing to the large amount of delicate mechanism within it.

Under the Searchlight.

Notes and Comments on Various Topics.

In the weekly financial review published by the well-known banking house of Henry Clews & Co., the following statement appears: "The most marketable properties in the world at the present time are new warships. While there is so much competition for them it is a good time for stock operators to be conservative." As Mr. Coffin and Mr. Westinghouse will therefore, owing to the unsettled condition of the market, find their present stock-jobbing industries rather dull, they might turn their attention to the class of "securities" indicated above. They would not find it difficult to form a trust in warships just now, and doing this would afford them some relief from the vexations of the situation.

* * *

OUR contemporary the *Electrical Engineer* is to be congratulated on adding another correspondence school to the number already in existence. We presume as this Institute is named after the paper it will be run as a supplement to the latter, or possibly the *Electrical Engineer* will be run as a supplement to the Institute seeing the latter is capitalized at \$50,000.

* * *

THE Lamp Pool held its monthly meeting on Friday last at the Hoffman House, New York. As there was little business to be transacted, the meeting was adjourned the same day. It behooves the Pool to keep careful record of their meetings, as some day, under the anti-trust law, they may be called to account for all of their "dark-lantern" conferences.

* * *

THE Hayden Electric & Mining Company was recently incorporated to furnish light and power for the town of Cripple Creek, Col., and the mines in the district. Capital stock, \$50,000. Incorporators: M. A. Ledy, C. S. Tschudi and Edward P. Creighton, all officers of the Cripple Creek Electric Light Company. There was some sharp practice in an endeavor to secure incorporation by this company. Another company had been organized under the above name, had obtained a franchise from the board of aldermen to furnish light and power in Cripple Creek, and was likely to be a dangerous competitor of the established company. The officers of the latter, the Cripple Creek Electric Light Company, determined to prevent this, and having learned, as they supposed, that the real Hayden Company had not filed their incorporation papers, called a hasty meeting, resolved to adopt the name of the rival

company, fixed upon the capital stock, had incorporation papers drawn up, took a special train to Denver, and finding no other company of that name on the records in the Secretary of State's office, went through the necessary formalities and filed their certificate of incorporation as the Hayden Electric & Mining Company. Subsequently it was discovered, however, that a mistake had been made. The real Hayden Company had filed its articles after all. The papers were filed on the afternoon of March 1 and had not been entered in the book. They were still in the pile of unentered companies awaiting their turn with the entry clerk.

* * *

MGR. ALEX. DOW of the Edison Electric Company was brought before the Recorder's Court in Detroit a few days ago on the charge of obstructing an officer of the Lighting Commission, and was fined \$5 and costs amounting to \$25. When sentence was pronounced Mr. Dow addressed the court as follows: "Your Honor, I am entirely satisfied that I violated a law, but I desired to regulate the modes of entering the establishment, and I did not mean to interrupt the officer in discharging his duties. I was ungentelemanly, probably, and it would have been a better course just to enter a protest than to throw the officer out, but we were mad. What I contend is that I have a perfect right to say what doors shall be used as a means of entrance and exit in our establishment, and that is what I wanted understood when I came in here."

* * *

MR. J. D. OLIGNY, contractor, of Montreal, is an unhappy inventor. He had spent much time on the invention and construction of an incinerator, and a public test was to have taken place this week, but previously a fire started in an old slaughter-house, at Cote St. Paul, where the incinerator was housed, and now nothing is left of it but a wreck. Mr. Oligny represented that he could destroy garbage by means of electricity and a certain solution which hastened decomposition. It did not matter whether the garbage was ashes, metal or stone, all would be destroyed, but the inventor did not make his incinerator fire-proof, and the fire fiend found it out. Mr. Oligny expects to repair the machine for a proper test.

* * *

ACCORDING to the New York *Morning Telegraph* the Westinghouse Company is circulating the following little story at the expense of its rival, the General Electric Company:

Be it understood in the first place that the General Electric Company is Charles Proteus Steinmetz, and C. P. S. is the General Electric Company. One could not go on without the other. To be more explicit, Steinmetz is the man to whom General Electric goes when it has a vast electrical problem to be worked out. General Electric fills Steinmetz up to the throat with figures, and says to him, "Make of them an electric machine that will be a marvel to the world and cause our rivals to turn green with envy." Steinmetz looks at the General Electric's representative with the calmly calculating gaze of a man who knows he has no equal when high voltage experimentation is in question, and says: "You comes to me at 'dis time next morning, and I for you haf der answer."

Then Steinmetz goes to work in his own peculiar manner. With a box of cigars and an urn of strong coffee he shuts himself up in his den at the General Electric establishment and gives himself up to thought. Those who have caught glimpses of him while he has been working out his problems say that he sits and smokes and sips coffee and gazes up at the moon through the window, as though the cigars and the coffee and the moon were his familiar demons. Steinmetz is supposed to go through awful travail of soul during these times, but the ideas that are born of his suffering have made his name famous all over America.

Recently some ill advised individual connected with the General Electric Company caused a notice to be posted around the place, forbidding any one to smoke. The intention was to reduce the rate of insurance and so effect a considerable saving to the company. The morning after the notice appeared, an apparition presented itself before the astonished eyes of the chief. It was dressed in traveling costume, shawled and gloved as though for a trip to the great Northwest. Divested of the shawl that enveloped

the upper part of his figure, Steinmetz stood disclosed. The chief gasped, and wondered what had happened to the great mathematician. The apparition extended towards him a gloved hand.

"I haf come to tell you good by," it said. "General Electric hafs no usage for mein surfaces longer. I go back to Chermanny."

"What on earth is the matter, Stein?" gasped the chief. "You haf stopped mein schmoking," answered Steinmetz. "No schmoke, no inventions. If my cigars you say go, then I go, too."

Of course, Steinmetz could not be allowed to go for such a small thing as a smoke, so the matter was patched up by Steinmetz being provided with a den in the foundry, the only part of the building where there is a fire, and here he now sits and wrestles with X, Y, Z, with his eyes fixed on the fire of the furnace instead of on the moon, and the other two demons in close attendance.

"A 'ROAST' FOR A ROASTER."

A circular sent out by a Trust company says:

"Try our anchored filament 220-volt lamp. The best one yet offered."

"This cut represents the standard 16 c. p. special called filament incandescent lamp."

[Here a cut of a lamp is shown.]

"Its proven superiority is the result of careful attention to the details in its manufacture, and the use of our special filament, which excels all others in maintaining normal candle power for a given length of time."

"While all filaments will decline in candle power, as used, the relative amount of the decline, other things being equal, determines the value of a lamp."

"A lamp, the first cost of which may be seventeen (17) cents, showing a loss of 25 per cent. in candle power at the expiration of 600 hours' burning, is an expensive luxury for the central station. A loss is incurred which should be anticipated, as the cut in price invariably means a cut in quality."

"When you buy oil, you insist on receiving four quarts to the gallon, not three; in the matter of coal you refuse to accept fifteen hundred pounds for a ton. Why buy and pay for sixteen candle power lamps that actually show but twelve candles in six hundred hours' service? Why pay seventeen cents for a lamp worth but thirteen—a lamp that is of low efficiency at the start and abnormally so before it has burned three hundred hours?"

"This company pledges itself to the actual delivery of the candle power it offers for sale. Whether the lamp purchased by you be of forty-five, fifty or fifty-five watts, you can depend on the candle power being full sixteen if the lamp be so marked."

"Furnish us information as to the condition of your plant and we will send you lamps that will meet the requirements. Lamps that will please you and your patrons. Lamps uniform in voltage and candle power, that produce a brilliant and maintained illumination."

The Warren Electric & Specialty Company, against whom this circular was evidently aimed, have published a very handsome circular in which they comment upon the above in a characteristic manner as follows:

"We don't need any better advertisement than to have one of the Trust companies advertise that our lamps have lost some candle power after 600 hours' burning. If their elastic consciences will not permit them to make a more damaging statement than this, the consumer can put two and two together and order the best lamps from us at the best prices."

"It now looks as if they intended to force themselves into good society by joining their name to the tail end of ours. They would not have been content a year or two ago to be tailenders. This is the name—Anti-trusticussibust. We have advertised ourselves as 'anti-trust.' This is the best part of the word. We account for the balance of the name in this way: According to the most authentic reports the Trust have spent a great deal of time in 'cussing' us, so it seems reasonable that 'cuss' having been uppermost in their minds, 'cussi' should seem pat to them (we don't understand the French of it, but no matter), and as one of the Trust companies 'busted' a few days ago the last syllable is accounted for."

"We pierced their armor. We thought we would find the weak spot after a while. We have tried to find out a number of times what candle-power their lamps would be after 600 hours' burning, but so far have utterly failed, for the reason that they did not burn that long. We do not know why we would not feel grateful to the lamp consumers. Wouldn't doubling your business make you feel so? We thank you for past favors, and solicit your further orders for our lamps at 17 cents in barrel lots for lamps capped with Edison or Westinghouse bases; one cent extra for lamps capped with T.H., United States, Brush-Swan or Hawkeye bases. All other bases 8 cents extra. Respectfully yours,"

"THE WARREN ELECTRIC & SPECIALTY COMPANY,
Warren, Ohio,"

"Manufacturers High Grade, Anti-Trust Incandescent Lamps."

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

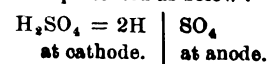
Chapter XVI.—Organic Chemicals and Dyes.

The application of electricity to the production of organic chemicals and dyes differs from all the applications that have hitherto been considered in these chapters, in the fact that the electric current is only used as an aid, and not as the sole agency, in carrying out the manufacture. These organic products are in nearly every case wonderfully complex combinations of atoms and groups of atoms. One of the modern synthetically built up dyes stands as far above such a compound as, say, sulphuric or hydrochloric acid, as a millionaire's palace stands above a mechanic's three-roomed tenement. The molecule of hydrochloric acid contains two atoms. The molecule of phenol-phthalein, one of the simpler organic dyes, contains 38 atoms, and the modern chemist is accustomed to building up step by step, in his laboratory, organic products containing a much greater number of atoms than this. The complex structure of these molecules containing such large numbers of atoms, each with a definite and fixed position relative to the others, of course necessitates a large number of successive steps in their manufacture. The organic chemist starting with benzene or naphthalene as his raw material, only obtains the dye or pharmaceutical product that he desires at the end of a long series of chemical changes and additions; and the popular idea that the most beautiful dyes lie hidden in coal tar is like many another popular idea—wholly at variance with the facts.

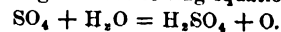
The production of such highly complex structures as those which we are considering, by a single series of primary or secondary reactions in an electrolytic cell, is of course out of the question, and it is thus only as an aid that electrolysis is used in the manufacture of organic chemicals and dyes. As an aid it is being extensively used, and it has been stated that nearly every German color works is now provided with an electric installation and the necessary accessories for electrolytic work.* The actual facts as to the different organic compounds in the manufacture of which electrolytic methods are used are difficult to obtain, but it has been stated that the firm of "vorm. E. Schering" of Berlin produce iodoform, the "Badische Anilin u. Soda Fabrik" at Ludwigshafen, yellow and congo reds, and Messrs. Bayer u. Cie. of Elberfeld, aniline dyes, by processes in which electrolysis plays a part.

I.—PROCESSES DEPENDING UPON OXIDATION OR REDUCTION.

In the production of organic chemicals and dyes, especially of those in which nitro-benzene is a starting point of the manufacture, oxidation and reduction play a most important part. It may be explained that an oxidation signifies a chemical substitution of oxygen for hydrogen or some other equivalent element in the molecule, while a reduction signifies the substitution of hydrogen for oxygen. It is here that electrolytic methods are serviceable, and at the present time in many German color works electrolytic oxidation or reduction has taken the place of the chemical methods earlier used for obtaining these results. If a dilute solution of sulphuric acid or any other mineral acid be electrolyzed between platinum electrodes, the acid splits up into positive and negative ions. If sulphuric acid be used, the change may be represented as below:



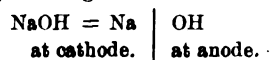
The SO_4 immediately reacts upon the surrounding water according to the following equation:



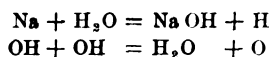
Oxygen gas is thus liberated at the anode, hydrogen

* "Die Entwicklung der Elektrochemischen Industrie," Zeitel. P. 119.

gas at the cathode, as the result of the electrolysis. These liberated gases at the moment of their passage from the ionic into the molecular state are in the condition known to chemists as "nascent," and thus it is possible to obtain oxidation effects at the anode, and reduction effects at the cathode, upon the other chemicals that may be present in the cell. In some cases, however, contact with an acid solution would lead to decomposition of the compound to be acted upon, or of the product desired. In such cases a dilute solution of caustic soda may be used. The electrolytic changes in this case are as follows :



These ions then enter into secondary reactions as follows :



The final results are thus nascent oxygen at the anode and nascent hydrogen at the cathode as before. The Farben Fabrik vorm. Fried. Baeyer u. Cie. of Elberfeld is the works in which the greatest use has been made of the electrolytic methods of reduction, and many of the processes which have been worked out and patented by Güttermann are now used industrially in this establishment. The facts that organic chemicals are poor conductors of electricity, and that the conductivity diminishes with increasing weight and complexity of the molecule, are much in favor of these new methods of procedure. If it were otherwise and if the conductivity of these complex organic compounds were equal to that of the mineral acids, the methods would be impracticable, for electrolysis would mean simultaneous decomposition of the organic chemical by the current. A few examples of these methods may be given as typical of the whole number.

Production of Aniline from Nitro-Benzene.—This is the second step in the manufacture of aniline dyes, the nitrification of benzene being the first.

The reduction of the NO_2 group in the benzene ring, to the corresponding NH_2 group that takes its place in aniline, is usually effected by means of hydrochloric acid and iron. Dr. Elbs has however shown* that if nitro-benzene be electrolyzed in the cathode compartment of a cell containing a dilute sulphuric acid solution in the anode chamber, by means of a zinc cathode, and a current density of from 90 to 136 amperes per square foot, a similar reducing action will be obtained, and aniline will be produced.

Production of Amido-Phenol from Nitro-Benzene.—If nitro-benzene be dissolved in five to ten times its weight of concentrated sulphuric acid, and be electrolyzed between platinum electrodes in the cathode compartment of a cell containing sulphuric acid in the anode chamber, with a current of $1\frac{1}{2}$ to 3 amperes and an EMF. of 5 or 6 volts, the sulphonic acid derivative of amido-phenol will be produced.† From this the amido-phenol itself can be prepared by the usual methods.

Production of Aniline-Black from Aniline.—This change is an example of oxidation, aniline-black being an oxidized product of aniline. The aniline is electrolyzed in the anode chamber of a strongly acid cell, with an anode of lead. Sulphuric acid should be used. The conditions require careful attention, as slight variations in the acidity of the electrolyte, temperature of the cell, current density, or material of the electrodes, lead to the production of different shades of green or greenish black.

Production of Various Dyes from Aniline Sulphate.—Rosaniline, chrysaniline and leucaniline may all be obtained by electrolyzing concentrated solutions of aniline sulphate, under varying current conditions, in the anode chamber of a sulphuric acid cell.

Further details of these may be obtained from the paper mentioned below.‡

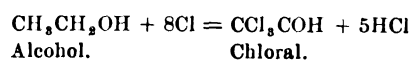
II.—PROCESSES DEPENDING UPON THE INTRODUCTION OF THE HALOGENS.

Turning now to processes in which the electric current is permitted to effect chemical changes other than those resulting from oxidation or reduction, the processes in which the elements chlorine, bromine or iodine (the halogen group) are introduced into the molecule by its instrumentality are the most important. The following three examples of this use of the current are typical of a very large number of others that cannot be treated of in detail:

Production of Iodoform from Alcohol.—Iodoform is an organic compound, similar in constitution to chloroform, but containing iodine in place of chlorine, and on this account being a solid at the normal temperature. It is much used in surgery. Its chemical formula is CHI_3 . The electrolytic method of manufacture depends upon the electrolysis of a solution of potassium iodide, in presence of alcohol and free alkali. The iodine liberated at the anode by electrolysis of the potassium iodide attacks the alcohol and replaces portion of the hydrogen contained in the alcohol molecule. This process was patented in Germany in 1884, and it is stated that the chemical firm "vorm. E. Schering und Cie." of Berlin are using it for the production of this chemical.* Doctors Elbs and Herz have investigated the conditions under which the best yield of iodoform is obtained. They find that a solution containing 50 grms. soda, 100 grms. potassium iodide, and 200 ccms. alcohol, in 1 liter water, a temperature of 60°C ., and a current density not exceeding 9 amperes per square foot, yields the best results.† The iodoform separates out as a solid in the anode chamber and should be removed hourly. Working without a diaphragm, a 60 per cent. efficiency can be obtained.

Chloroform and bromoform can be produced by similar methods, but the yield in the case of these chemicals, which are fluid at the ordinary temperature, is bad.

Production of Chloral from Alcohol.—Chloral is not only important as a narcotic and anæsthetic, but it is a chemical from which chloroform can easily be produced by the action of caustic potash. Its chemical formula is CCl_3COH . In order to obtain chloral electrolytically, a concentrated solution of potassium chloride is electrolyzed in a vessel divided into anode and cathode compartments by a diaphragm. The cathode is of copper, the anode of carbon; the latter is movable and is used for stirring the mixture in the anode chamber of the cell. The electrolysis is conducted at a temperature of 100°C ., and during its progress alcohol is allowed to flow into the anode compartment of the cell in a continuous stream. The chlorine liberated at the anode immediately attacks the alcohol, forming chloral and hydrochloric acid according to the following equation :



The potassium liberated at the cathode reacts with the water in the usual manner to form caustic potash and hydrogen. The caustic alkali is used to neutralize the acid formed in the anode chamber, potassium chloride being thus regenerated.

The theoretical yield of chloral would be 217 grams per EHP. hour, as 8 atoms (282 grams) chlorine yield one molecule of chloral (= 147 grams). The actual yield is stated to be 50 grams per EHP. hour, or 23 per cent. of that shown to be possible by theory. In these organic reactions, however, the expenditure of energy is altogether of secondary importance, the electrolytic methods being used on account of their greater convenience and neatness. This method for the production of chloral is stated to be in use at the chemical works of vorm. Schering u. Cie. in Berlin.‡ It is also stated that glucose, starch and sugar may be substituted for alcohol in carrying out the method.||

III.—MISCELLANEOUS USES OF THE CURRENT.

The purposes for which the electric current is used in the preparation of organic chemicals and dyes are not confined to the two broad classes of reactions that have been noticed in Parts I and II of this Chapter. Many other reactions than those of which typical examples have been given can be carried out through its agency. Limits of space forbid mention of more than two of these miscellaneous uses of the current.

Production of Cyanides and Ferrocyanides.—A very large number of patents have been taken out in recent years having for their object the direct production of cyanides from the nitrogen of the air. Readman in British patent No. 6,621 of 1894 proposes to obtain cyanides (and ferrocyanides) by fusing a mixture of oxides or carbonates of the alkalis and alkaline earths with carbonaceous materials (and iron) in an electric crucible or furnace. Nitrogen or generator gas is then allowed to pass over the fused mass, and direct union of the nitrogen with the other elements is said to occur. The writer is informed by the patentee that the patent rights of this process have been bought by a large company, and that manufacturing operations upon a large scale will shortly be commenced.

Production of Prussian-Blue and Other Cyanogen Compounds.—Goebel has patented a procedure* for the manufacture of prussian-blue by an electrolytic method. Solutions of potassium ferrocyanide and ferrous sulphate are prepared, and the turbid solution produced by their mixture is electrolyzed in the anode chamber of a sulphuric acid cell. Several shades of green and blue, representing differing stages in the oxidation of the ferrous cyanide to ferric cyanide, can be obtained by staying the electrolysis when the required tone is reached.

Conclusion.—In closing this review of the application of electricity to the manufacture of organic chemicals and dyes, the writer must emphasize the fact already noted that it is as an aid to the ordinary methods of procedure that electricity will be used in this wide field, and that in the majority of instances the greater number of changes involved in the production of any organic chemical will still be obtained by ordinary chemical methods of work. That, as an aid, electricity will be used on a continually widening scale in the field of organic chemistry is proved, not only by the statements of Oettel upon this subject,† but also by the increasing number of processes and reactions, published in the scientific papers and journals dealing with organic chemistry, in which electrolytic action plays a prominent part.

Electric Projects in France.

Consul Jackson, at Cognac, France, has reported to the State Department at Washington that the city of Niort proposes to have an electric railway and lights for its streets. Manufacturers interested in this subject can obtain any information by addressing Monsieur le Maire de la Ville de Niort, Deux-Sevres, France.

The Consul says there is also a movement on foot to connect La Rochelle with the new port, La Pallice, by an electric line $2\frac{1}{2}$ miles long. Communications in regard to the matter should be addressed to Monsieur P. W. Morch, Chamber de Commerce, La Rochelle, France.

The Dawson City Electric Company is applying to the Dominion Parliament for an act of incorporation. The company ask to supply electric light, heat or power throughout the city, and within a radius of 200 miles, as well as to operate an electric tramway.

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

* Chemiker Zeitung, 1893, p. 209.

† Güttermann. Ber. d. deutsche, Chem. Gesell., Vol. XX,

1916.

‡ Voigt. Zeit. f. Angew. Chemie, 1894, p. 107.

* Moniteur Scientifique, XI, part 1.

† Zeits. f. Elektrochemie, Vol. IV, p. 113.

‡ Ahrens. Elektrochemie, p. 480.

|| Lumière Electrique, 1894, Vol. LII, p. 226.

* British patent No. 14,039; 1893.

† "Die Entwicklung der Elektrochemischen Industrie"; p. 119.

DEATH BY ELECTRICITY.*

BY W. S. HEDLEY, M.D.

It is not always so easy as might be supposed to kill an animal by electricity. The experiments of Brown-Sequard and D'Arsonval long ago (1884) showed this, and many physiologists have since confirmed it. Kratter found that one short application of an alternating current at 1,500 volts sometimes did not kill either rabbits or guinea-pigs. Yet much lower voltages have often proved fatal to man. Indeed it seems not improbable, as the writer has stated on previous occasions, that all commercial forms of electric lighting currents, varying as they do from 80 volts upwards, may be dangerous to human life under certain conditions. It is, of course, true to say that, other things being equal, risk increases in direct proportion to the electromotive force; but absolute equality of "other conditions" can never be secured. The duration of the application, the nature of the contact, its superficial area and position, the condition of the skin, the periodicity of the current, the species of animal, its weight, age and perhaps even its state of health, are all factors in the result. That duration of contact has a most important bearing on the question is nothing more than might be expected, for reasons both physical and physiological, and all experiment proves it. It has been shown† that currents, easily borne by an animal when momentarily applied were fatal when the application was prolonged to 5–10 seconds. On the other hand, short but repeated applications of strong currents were almost invariably fatal. When other conditions are the same, the larger the area of contact, the greater the intensity of the current but the less its density, and the latter can never be left out of consideration in dealing with physiological effects. The condition of the skin, with reference to moisture, or any breach in its continuity is also a point of the first importance, inasmuch as the epidermis is the great insulator of the body. But, at the same time, it is to be remembered that the degree of skin injury is not always proportional to the gravity of the accident. Frequency of alternation must also be considered. It may be that fatal effects are in inverse ratio to the periodicity, although not perhaps according to a strictly "straight line law." Animals present differences in their resistances to the effects of electric currents according to their species, and even according to their individual peculiarities. Every animal seems in this respect to be a law unto itself. It was found in the experiments already alluded to that rabbits often survived currents which proved fatal to dogs ten times bigger. In the original electrocution experiments in America, experiments were made upon a horse, three calves and a number of dogs. The mean fatal current thus obtained was brought to bear upon the man to be executed, and the result proved a painful *fiasco*. Yet many experiences since then, some of them within recent months, have proved that a low as well as a high electromotive force may kill a man.

It is very generally admitted that in the case of animals killed by strong currents there is a tolerable uniformity in the post-mortem appearances: (1) The latter in many respects resemble those seen after death by asphyxia (*apnoea*); that is to say, the left side of the heart is comparatively empty, whilst its right side and the larger veins near it are distended and filled with dark fluid blood. The absence of hemoglobin from the blood is also a fact common to death by electricity and to death by *apnoea*. (2) The nervous system does not seem to present any very characteristic appearances—at least there is no gross "lesion" which can be said to be constantly present; but slight hemorrhages in the walls of the fourth ventricle and in the meningeal coverings are not rare. Yet there may be many finer molecular changes in the nervous tissues of which present

methods of investigation are not able to make us cognizant. (3) The points of penetration of the current are always evidenced by burns of various degrees. Less constantly the place of exit is similarly marked. These burns of entrance have considerable diagnostic value in cases when the cause of death may be in doubt. They may vary in severity from simple redness to complete destruction of the whole thickness of the skin; but, as already said, their severity has no close relationship with the gravity of the accident.

When a strong current is brought to bear upon a living animal, there is immediately a strong tetanic contraction of the entire striated muscular system; and on the circuit being broken there is often a deep inspiration, perhaps followed by an "expiratory cry." It is often this cry which first calls attention to the accident. In cases which are not fatal there is often loss of consciousness, which may be regarded as the clinical manifestation of the severe shock, or rather shaking, to which the whole central nervous system has been subjected. This is very different from what is surgically known as "shock." In the latter, the longer the condition of shock lasts the greater the danger. In electric accidents, danger of death diminishes, the longer the duration of loss of consciousness. It may be said that, if not immediately killed, the person usually recovers. This loss of consciousness soon disappears, perhaps even in a few minutes, but for days or weeks there may remain "head symptoms," such as vertigo and severe headache, or there may be palpitations or other such consequences. Neither sensory nor motor paralysis appears to be common.

Death, as the result of electricity, must occur in one of two ways:—(1) by mechanical lesions of vital structures, or (2) by arrest of organic functions essential to life; that is to say, by arrest of respiration, heart action or nutritive exchanges. It is in persons killed by lightning that the first named mechanical or "disruptive" effects are usually seen. Industrial currents kill in the second way. But even here the difference is quantitative rather than qualitative. Most of the foregoing points have been put in evidence by Kratter and others, and, as already said, are generally accepted. The first class of cases need not be considered. It is self-evident that mechanical disintegration of vital parts must cause death. But, approaching the second class of cases, where death occurs by arrest of organic functions essential to life, the question broadens out, and it becomes necessary to inquire which of such functions is struck first. Where does death begin? What is the "mechanism" of death by electricity? At this point physiologists are no longer in accord.

As it is D'Arsonval considers, that acting on nervous centers the electric current produces a variety of effects known as "inhibitory," viz., suspension of respiration, arrest of heart action, etc., and that it is the first of these that is primarily affected, inasmuch as cardiac action persists after the arrest of respiration. According to this view, there occurs, in fact, "a central paralysis of respiration, constituting a special form of asphyxia,"* due to exhaustion of the medulla and functional death of the ganglion cells. If this be correct, artificial respiration affords a hopeful means of restoring animation. This condition of suspended respiration must not be mistaken for death, and a post-mortem examination at once proceeded with. "Neoprosies vivants" is the sensational term which, it may be remembered, was used in connection with the autopsy of the first electrocuted criminals in America.

Dr. Tatum of New York, experimenting in 1890, came to the conclusion that strong currents kill by acting chiefly or entirely on the actual substance of the heart itself.

In 1895, Dr. L. Jones, having witnessed some experiments undertaken by Mr. Bokenham with reference to the amount of current required to kill anesthetized cats, considered, from an inspection of the

respiration and blood pressure tracings, that death began at the heart, and that the action of the current is "upon the heart muscle rather than upon any of its nervous mechanisms." In the *British Medical Journal* of January 15, 1893, there appears a paper by Drs. Oliver and Bolam on the same subject, arriving at the same conclusion and by the same methods, but not giving such details of amperage and voltage as would enable the experiments to be repeated by others.

Against these latter views it has been urged that were the heart's action suddenly arrested by the electric shock, there would not be the great disproportion in the amount of blood on the two sides of the heart that is present in death by electric shock. After sudden arrest of the heart's action, the amount of blood on the two sides of the heart is nearly equal.

Further, the heart theory rests chiefly on blood pressure tracings, and it is to be remembered that blood pressure is the result of other factors in addition to the action of the heart.

This leads to another hypothesis. Dr. Bleile, of the Ohio State University, suggests, as the result of carefully conducted physiological experiments, that death by electric shock is entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system; that is to say, through an effect on those nervous centers which control the diameter of the arteries, and that a constriction of the arteries so produced throws in such an impediment to the flow of blood as the heart is unable to overcome. This last-named hypothesis no doubt contains an important truth, recognizing, as it does, the fact of peripheral obstruction as influencing blood pressure.

It is, however, contended* that the fatal obstruction is not in the systemic arterioles, but is owing to a constriction of the pulmonary arterioles, the latter being excited to contract by the entirely deoxygenized blood. Such a theory obviously falls into line with the post-mortem conditions, which, as has been seen, resemble those seen in *apnoea*.

It would, therefore, appear, not perhaps that these hypotheses are each at hopeless variance, but that death from electricity may be accomplished by various physiological mechanisms. First, and perhaps oftenest, it may be by sudden arrest of respiration; at another time it may be brought about by sudden and primary stoppage of heart action; in either case, the result being not improbably due to physiological death of the centers of respiration or circulation from chemical and morphological changes therein which present methods of observation do not enable us to recognize. Further, it is certain that these two centers act in unison, and it need not be surprising that the incidence of the damage done by the current may not always be distributed in the same way. But in accepting the foregoing, it is not to be overlooked that the view that fatal results from electric currents are due to damage inflicted within the actual structure of the heart itself is very influentially held, it has never been disproved, and may ultimately turn out to be a cause, if not the cause, of death from electricity. Thirdly, mechanical or disruptive lesions, such as tearing of blood-vessels and contusions of the surface of the brain, are not limited exclusively to accidents by lightning, but have also been observed in a modified form in cases of death from industrial currents.

It is sufficient to say that, notwithstanding the experiments of physiologists, and a growing experience of such cases, all that medical treatment can do is still to be summed up in the original formula of D'Arsonval, "Un foudroyé doit être traité comme un noyé"; in other words, by artificial respiration commenced early and continued long. But there is one further point with reference to this to which brief allusion may be made. It is known to physiologists that animals to whom nitrite of amyl has been administered are more difficult to kill by electric currents than are animals not under the influence

* From the *Electrical Review*, London.
† Kratter.

* Kratter.

* *Lancet*, October, 1895.

of that drug. It acts by paralyzing the walls of the small blood vessels, and so doing away with both arterial constriction and pulmonary obstruction. Now, without advocating that capsules of amyl nitrite should form part of the equipment of every "first-aid," it may be suggested that the use of this drug in cases such as drowning and electric shock would in safe hands prove a valuable adjunct to artificial respiration.

ON THE MANUFACTURE OF LAMPS AND OTHER APPARATUS FOR 200-VOLT CIRCUITS.*

BY G. BINSWANGER BYNG.

In the progress of electrical industry, manufacturers have become accustomed to sudden demands arising from a discovery or a successful experiment, and I purpose to deal with apparatus which manufacturers are called upon to make to meet the requirements of the latest innovation—i. e., the distribution at a potential of 200 to 230 volts. Central station engineers have thus arranged their three-wire system, relying upon makers to successfully alter lamps and minor fittings incidental to such a change. Their expectations have been fulfilled in a measure only. The ultimate success of the high-pressure system will depend largely upon the verdict of the consumer, and he will give it in its favor only if his fittings in points of efficiency, economy, safety, convenience and appearance approach the standard which he can obtain by means of the lower voltage system.

It is, therefore, of importance that the central station engineer should assist the manufacturer to arrive at such perfection. His instructions, so far, have hardly gone beyond the demand to supply him with fittings to conform in appearance to the 100-volt system. It is true each central station has issued rules, but they are of little help to the manufacturer, and their very disconformity shows that there is neither unanimity nor correlation of ideas between the engineers in charge.

What is wanted is to have a thorough interchange of opinion of engineers, contractors and manufacturers. The latter would then know theoretically how far they may satisfactorily depart from the present practice, and thus save much time and money in adventitious experiments; and this also might tend to produce some degree of standardization—much to be desired in the interest of all who have the success of the new system at heart.

With this object in view I bring this paper before you, and I think I can best serve the purpose by describing the chief appliances now upon the market, or under manufacture at my works, pointing out the existing deficiencies, and giving you my views upon the attainment, as far as possible, of higher perfection.

INCANDESCENT LAMPS.

Most important in connection with this subject is the incandescent lamp.

The lamp manufacturers have been compelled to supply 200-volt lamps at a given candle-power and efficiency, in the same size bulbs as are used for 100-volt lamps. With flashed carbon the manufacturers meet with the great practical difficulty of properly disposing their long thin 200-volt filament in the same space as their shorter and thicker 100-volt filament, and therefore most of them solve this problem by resorting to a filament of much higher specific resistance than would be given by the flashing operation.

Unflashed Filaments.—Such a lamp is ready to the maker's hand by simply taking his ordinary carbon filament as it exists before being flashed—that is to say, before it is reduced by a fresh layer of carbon being deposited on the surface of the original filament.

The higher specific resistance of an unflashed car-

bon enables one to easily get over the difficulty of size of bulb, as such a filament will give the necessary resistance by taking a shorter length. Such filaments have also a greater emissivity, owing to the darker and rougher nature of their surface, than that of flashed filaments; consequently they require a less amount of surface per candle-power, and therefore the mass of an unflashed filament, at a given candle-power and efficiency, is less than that of the flashed filament.

The filaments of high-voltage lamps largely used to-day are therefore, in other words, faster converters of energy into heat and light than flashed filaments of the same candle-power and efficiency, although the watts supplied to each be the same.

On comparing the behavior of such 200-volt lamps with that of 100-volt lamps, the roughest of tests shows that there is a far more rapid falling off of candle-power during life with the former than the latter. At the same time the efficiency of an unflashed lamp decreases in a given number of hours by a far greater percentage than is the case with the flashed lamp. Mr. Robertson has made a series of life and efficiency tests on high-voltage lamps. They show that in the average unflashed 200-volt 16 CP. lamp the percentage loss of candle-power in 600 hours is about 42 per cent., and the average drop of efficiency is about 35 per cent.

These two quantities seem to cover the chief practical merits desirable in an incandescent electric lamp—i. e., the lamp which has the best percentage retention of original candle-power during its life, together with the best average percentage (or increase) of original efficiency during its life.

These tests show that these most desirable points, which have been worked on diligently for the last thirteen years, have had to be thrown on one side in order to bring about the possibility of using the same sized bulb for a given candle-power at 200 volts as at 100 volts.

Tests of the behavior of unflashed high-voltage lamps show that such lamps sometimes increase in candle-power during the first 100 hours or so. This also happens with badly carbonized or badly flashed 100-volt lamps (noted by Prof. Ayrton in some of his recent lamp tests), owing to the initial lowering of their resistance in consequence of their not having been properly carbonized in the first instance; and this is often accompanied by a great alteration in the character of the surface (emissivity) of the filament. The carbonizing or baking process is therefore still going on in the lamp, and the two above-mentioned changes coming together mask the fact that a great deterioration of the filament has taken place; but a period is quickly reached when this fact is no longer masked. This period is when there is no further decrease of resistance; but the surface deterioration still goes on, and thus soon brings about a large percentage fall of candle-power, and on the slightest increase of voltage there is now a tendency to increase resistance. These changes seem to be initially owing to the fact that the (unflashed) high specific resistance carbon is far more volatile than is the case with a good flashed carbon.

A microscopical examination of a flashed and unflashed filament after each has been running 100 hours shows that the surface of the flashed filament is still quite smooth and shiny, whereas the surface of the unflashed filament has become very dull, sooty, and often full of small pit-holes. These pit-holes and soot form a large increase of surface, which therefore increases the emissivity of the filament, and consequently lessens its candle-power, as the watts supplied keep the same.

The property of an unflashed filament becoming so rapidly less efficient (increasing in watts per candle-power) acts as a preservative, because the increased emissivity lowers the temperature. This lowering of temperature decreases both the tendency to volatilize and also to further great change of resistance. This power of self-preservation leads to such a filament giving some satisfaction to the gen-

eral public, for the latter is satisfied when it obtains a good average, or sometimes an excessively long-life lamp; but this is very false economy, as it is only purchased by a very great falling off in actual efficiency.

Mr. Robertson's experience with carbon filaments seems to point to the fact that it is impossible to obtain a carbon filament of high specific resistance without its being accompanied by at least the defect of greater volatility. In other words, the lowest specific resistance carbon is the best, because it is less liable to evaporation, and therefore it gives the best retention of original candle-power and efficiency, and it is also mechanically stronger.

The specific resistance of many of the present types of 200-volt lamps is about 3,500 to 5,000 microhms per cubic centimeter, whereas it is easy to obtain flashed carbons whose specific resistance is as low as 2,400 microhms per centimeter; and even as low as 300 is possible, but not practicable.

Gases.—Another important consideration to bear in mind as to whether the high or low specific resistance carbon is the best is, that the high specific resistance filaments retain their occluded gases in a far more persistent degree than is the case with the low specific resistance flashed filaments.

It is probable that the occluded gases arising from the carbonization of the filament are, by means of the flashing process, driven off to a large extent; and, in addition, the more dense and impervious nature of the flashed surface prevents the filament from absorbing the gases during its subsequent handling or treatment. This absorption is a property possessed by all carbon bodies in some proportion, varying with their density.

This greater power of unflashed carbon to absorb gases and to retain what it has absorbed than is possessed by flashed carbon, leads in many instances to sudden deterioration of the vacuum in a finished lamp, accompanied by a short-circuiting as soon as the pressure and the condition of the residual gases in the bulb has reached its most conductive point.

The consensus of opinion at the present day of the average types of high-voltage lamps undoubtedly points to the fact that a large percentage are expected to short-circuit as soon as they are put up, and I have heard several engineers say that they expect about one in twelve to go in this way.

From these causes, and others relating to the treatment of filament pointed out above, there seems to be no doubt that the average 200-volt lamps have a shorter life than 100-volt lamps. The above experiences have led Mr. Robertson to design all high-voltage lamps that are not restricted by size with well-flashed carbon filaments, and such lamps compare favorably with lower voltage lamps.

Horizontal Burning.—Another question which is very important in considering 200-volt lamps is that of horizontal burning, and contractors should take special notice of this. There is no doubt whatever that almost all the present-day 200-volt lamps are only suitable for burning in a vertical position. As soon as any other position is adopted defects become prominent. The long thin filament soon drops on to the bulb and cracks it. Also electrostatic attractions, owing to higher voltage, cannot be resisted by the long thin filament, and this is an additional cause of the filament approaching the bulb.

The effect of electrostatic attractions on long thin filaments is even noticeable with lamps burning in a vertical position. Such lamps have to be designed with the object of making their filaments more rigid, and to be thus able to withstand the effects of gravity and electrostatic attractions exerted by the charge on the bulb; and this is the chief point which makes high efficiency 200-volt lamps so difficult to produce. There is, therefore, a tendency in trying to avoid the defects just mentioned to make 200-volt lamps as low in efficiency as possible.

Leading-in Wires.—Another fault that exists with the bulk of the present forms of high-voltage lamps is that, owing to the same size bulb being retained,

* Paper read before the Institution of Electrical Engineers, London, Eng., Feb. 24, 1898.

no greater separation can be given between the leading-in wires of the lamp. This is a special difficulty with high-voltage lamps which contain two filaments, as in this case the same size cap is used, and four wires are passed through the sealing point instead of two, and they are therefore more crowded together. This question of distance apart of leading-in wires is a vital one, both in the manufacture of the lamp and in its after use. In the case of unflashed carbons this becomes a still greater defect, owing to small distance combined with probably greater gaseous emanation.

The higher the voltage, the sooner are these defects made manifest. Even with 100-volt lamps there is, under certain conditions, a tendency for current to jump across from pole to pole, owing to the remanent gases in the bulb attaining a high state of conductivity. The greatest conductivity of the remanent gases which lead to sudden short-circuiting appears to be when the pressure is about 0.01 mm. But, by reason of a continued discharge taking place in all lamps, there seems to be a tendency for the residual gaseous molecules to arrange themselves in a straight path between each pole. Through such a path discharge will take place even in a better vacuum than 0.01 mm.

This leakage current (sometimes called the "Edison effect") which leads to short-circuiting is very prominent during manufacture of high-voltage lamps, and to avoid it greater care is required as the voltage increases.

If the size of a bulb for a high-voltage lamp is to be restricted to the present dimensions, there is no doubt that the best lamp would still be that which has a single filament, were it not that other vital questions step in.

Electrostatic effects also increase with the voltage, and several most promising patterns of lamps, from all other points of view, have had to be put on one side on this account.

As to the best forms of cap for high-voltage lamps, preference will naturally be given to those in which the poles can be kept furthest apart.

If a B. C. or E. S. cap were on a larger scale, there is no doubt that considerable benefit would accrue. The simplest holder, with the least moving parts and for always making the best contact, is undoubtedly the Edison screw, which, in the cases of excessive vibration, can be made with a locking device.

The slightest want of insulation in the cap between the poles eventually leads to a large leakage current between them or the cap and one of the poles, and in many cases this is suddenly established to such a large degree as to result in the complete fusion of the lamp cap, and sometimes the holder. In such cases a non-metallic lamp cap seems to offer great advantages, and has, in my experience, removed complaints on this score.

Standard Voltage.—From a lamp maker's point of view, a fixed standard of voltage and efficiency would only lead to an increased cost in manufacture, and the present practice of varying efficiencies with voltages, running in the case of low-voltage lamps from 95 to 120, and in the case of high voltage lamps from 200 to 230, tends to keep the lamp at a lower cost than if these efficiencies or limits of voltage were more restricted.

On the other hand, voltages which lie outside these limits are a source of great expense to the manufacturer. It would therefore tend to cheapen lamps if a standard of voltage were adopted which lay exclusively between the above or even smaller limits, but at varying efficiencies.

Combination Filaments.—In order to get over the difficulty of size of bulb, etc., many filaments (beyond the unflashed pure carbon derived from cellulose in some form) have been introduced which have a high specific resistance. This can only be obtained by using a less dense form of carbon than has hitherto been found most satisfactory in low-voltage lamps.

A form of high specific resistance filament that has been tried is where the carbon has been admixed

with various oxides, borates and silicates of the earths. In addition to mixtures, electrolytic and chemical deposits of these bodies on the surface of carbon have been tried; but, although it is a simple matter to obtain baked carbons containing these bodies, either incorporated with the carbon or on the surface thereon, it is quite another matter to obtain a finished lamp containing these bodies in a form to be of any practicable use. The difficulties met with are apparent as soon as the lamp is incandescent while undergoing exhaustion.

If such lamps be incandescent to a temperature exceeding 5 watts per candle-power, there is a gradual separation by evaporation of these bodies from the carbon, and their resulting deposition on the surface of the lamp bulb.

The temperature of incandescence of the filament in order to obtain any advantage which might be derived from the "luminescence" of the rarer earths is apparently greater than 5 watts per candle-power; and, as above stated, it has been found impossible to so evacuate a lamp as to leave any of the "luminescent" bodies incorporated with the filament at temperature higher than 5 watts per candle-power; the object sought for is consequently defeated.

From the above it seems that, with our present knowledge, the best form of 200-volt lamp is that which has a well-flashed low specific resistance pure carbon filament in a large bulb, with a well-insulated moisture-proof cap allowing the poles to be placed at a reasonable distance apart. It should consist of a single filament, and be so disposed in the bulb that it can withstand the disturbing effects of gravity and electrostatic charges on the bulb.

I wish to mention here that my co-director, Mr. Robertson, has given me great assistance in the remarks I have made upon lamps.

(To be continued.)

ELECTRICAL ENGINEERING IN SPAIN.*

Mazarron, a provincial town of some 14,000 inhabitants, is situated in the southeast of the province of Murcia, and is the most important center of the mining district of the southeast coast of Spain, midway between Carthagena on one side and Aguilas on the other. The town of Mazarron is approached from the Mediterranean by the "Puerto de Mazarron," or port, which latter has a population of 3,500 inhabitants, and is under the same municipal government as the town itself. The port is 6½ kilometers distant from the town, and the Mazarron Electric Light Company intend shortly to extend their high-pressure cables from the generating station at Mazarron, in order to supply the light also to the port, the lighting of which is included in their concession. The exclusive concession for the electric lighting of Mazarron for fifty years was obtained by the Mazarron Electric Light Company (Limited).

In Mazarron, as in most provincial towns in Spain, the only illuminant obtainable is petroleum, and in consequence of the very high price of this illuminant in the country, due to heavy Government taxes on its introduction, refining and consumption, the danger in its use and the difficulty in procuring the thoroughly refined oil, except at excessive prices, afford special advantages to electric light undertakings—a fact which can be seen by the rapidly increasing number of concessions being taken by the English and other companies for the supply of electric light to Spanish towns.

The contract of the Mazarron Electric Light Company with the municipality of Mazarron was concluded in May, 1897, and already the equivalent number of lamps of 10 CP. connected up is over 1,000, the present plant being capable of supplying 3,500 lamps of 10 CP. The municipality at present use 300 lamps, including 10 CP. and 16 CP. glow lamps in the streets of the town, and one 2,000 CP. arc lamp in the plaza or market-place. For these they pay at the rate of 50 centimos per 1,000 watt-

* From the *Electrician*, London.

hours, or, taking the mean of the rate of exchange, equivalent to about 4d. per British B. O. T. unit. The price paid by private customers is at the rate of 6 pesetas per month per 16 CP. lamp if by contract, or if by meter, 80 centimos per 1,000 watt-hours, which in a similar manner averages 6.4d. per British B. O. T. unit. The cost of the same intensity of light as that of one 16 CP. incandescent lamp, if produced by the ordinary petroleum obtainable in the town, is about 7 centimos of a peseta per hour; while the present charge to private consumers for the electric light is equivalent, at the above rate, to 5 centimos per 16 CP. lamp-hour. Thus the advantages in economy and superiority of the electric light over petroleum are at once evident to the residents, rich and poor, and the light is being rapidly taken up by all classes.

The system adopted at Mazarron has been the high-pressure alternate current system, with transformers, the motive power adopted being steam, in consequence of the absence of any available water power in the neighborhood. The alternators are of the well-known Mordey-Victoria pattern of 2,000 volts, 100 periodicity, with direct-coupled exciters, constructed by the Brush Electrical Engineering Company (Limited), and at present the plant comprises two alternators of 30 kilowatts each, and one alternator of 35 kilowatts, intended for parallel working. The engines include a 60 HP. vertical compound high-speed engine built by Messrs. Robey & Co., Lincoln, with Pickering governor and variable expansion gear, and a 60 HP. locomotive type of boiler by the same makers. Messrs. Hornsby & Sons, of Grantham, have supplied a 75 HP. under-type automatic expansion engine and boiler, and this latter engine at present drives one of the 30 kilowatt alternators by link-belt and jockey-pulley gear. The third alternator is at present kept for reserve.

The power station is situated at the extreme north-east of the town, a more central position having been unobtainable. From this station the line of cables is carried overhead, the high-pressure feeders and cables being rubber-insulated and carried on specially constructed insulators attached either to upright posts or to wall brackets. The low-pressure house service system is similarly carried in lines of aerial cable with insulated covering and special porcelain insulators. At present there are nine transformers working on the town circuits, the units chosen being mostly 2 and 3 kilowatt transformers arranged in parallel and feeding the low-pressure network. The transformers are placed in overground chambers in the streets in convenient situations, and at each transformer-box a distributing post is fixed, to which also is attached the branch cables connecting with the high-pressure feeders, these, of course, entering the transformer chamber. The transformers were supplied by Messrs. Crompton & Co., and by Messrs. Johnson & Phillips. In consequence of the phenomenal dryness of the climate in Mazarron, rain rarely falling throughout the whole year, and the intense heat, it has been found quite easy to effect perfect insulation of transformers and overhead circuits; and the overhead system has been universally adopted in such parts of Spain as it gives the best results with the greatest facility and cheapness of construction.

The old form of petroleum lamps, or "faroles," in the market-place have been replaced by a 2,000 CP. alternate-current arc lamp, connected through a supplementary arc-lamp transformer to the house service line, which is worked at 110 volts throughout the town. The company have already supplied light to the San Jose mine; and it is expected that contracts will be entered into shortly with the other mines in the district for supply of the light both above the surface and underground. The great industry of Mazarron is that of the mines, which lie immediately round, many being partly within the town itself. These mines are among the richest in the country and in Europe in lead and silver, the lead ore being conveyed for smelting to the lead works at the port, from whence it is shipped to England and abroad.

LONDON NOTES.

[From our London Correspondent.]

Alternate Current Motors.

Mr. Llewellyn B. Atkinson has been reading a paper before the Institution of Civil Engineers, London, on the theory, design and working of alternate current motors. The author dealt mainly with asynchronous motors. The principles of alternating currents, so far as necessary for their use in alternate-current motor design, were explained, and the method of graphically making the necessary calculations was illustrated. In his classification Mr. Atkinson took as the first class motors in which the energy was conveyed to armature through brushes, and which were therefore called "conductive motors," which might be series wound, shunt wound, or separately excited; in the latter case the phase of the EMF. producing the exciting current differed by a quarter period from that producing the armature current, thus forming an example of the application of multiphase currents to alternate-current motors. The transformation of energy from one circuit to another by electromagnetic induction instead of by conduction was considered, and the working of transformers both with magnetic leakage and without magnetic leakage between the primary and secondary windings was illustrated. This gave rise to a class of motors in which the energy was supplied to the armature, not through the brushes, but through the air gap; these motors in the simplest form having, however, a commutator for short-circuiting the coils so as to produce a proper distribution of current in the armature. These motors the author classed as "inductive motors with brushes, having one inductive electric axis and one magnetic axis." A modification of this class furnished a third class, "inductive motors with brushes," in which there were "two reciprocal inductive electric and magnetic axes." The brushes might then be dispensed with, giving rise to a class of "inductive motors without brushes, having short-circuited coils and two reciprocal inductive electric and magnetic axes," the modern induction motor. The theory of such motors was examined, and the use of asynchronous motors as generators was touched upon. The design of alternate current motors and the practical construction and working of asynchronous motors also formed part of the paper.

The Dublin Three-Phase System.

Mr. H. F. Parshall has just read a paper before the same institution regarding the operation of the Dublin electric tramway system since its inauguration two years ago. As originally designed, the Dublin Southern Tramways would not conform with the Board of Trade regulations in the matter of fall of potential in the earth return. The machinery had been ordered and the work proceeded with before Mr. Parshall was called in to advise. The problem became, therefore, to utilize as much of the machinery ordered as possible, and to install such other machinery as would be necessary to distribute the electricity under the Board of Trade regulations. The high-tension, alternate-current method of transmission was considered most suitable. It was necessary to make use of the sites owned by the tramway company and to execute the work as cheaply as was consistent with safe operation. The three-phase machines and switchboards were specially designed for the installation, which was the first one of its kind established in the British Isles. The installation has been in operation—entirely satisfactorily—for nearly two years. So simple is the operation of the substations that only a boy is employed in each to work the machinery. Owing to the low frequency the motors were very easily synchronized, and even though they were thrown in considerably out of phase, they quickly fell into step. Numerous additional cars increased the load greatly, but the machines never gave trouble, nor have the asynchronous motors fallen out of step, even in the case of

most severe loads. The Board of Trade requirements had been satisfactorily met, and owing to the number of points of distribution it was possible to work some sixty cars on the line instead of twenty as originally designed to comply with the Board's regulations. As originally designed the fall in potential in the earth return would have been some 18 volts to 20 volts, whereas in the present plant it was 3½ volts. At the time the installation was designed, twenty cars were contemplated, but it had since been found profitable to work as many as fifty on the line, even though the line had been subjected to the disadvantage of not having a thorough connection to the center of Dublin. Owing, therefore, to the largely increased load, the capacity of the powerhouse at Ballsbridge had been greatly added to by a large direct connected unit which was more suited for heavy traction loads. Likewise the substation at Blackrock had been redesigned and in the place of the 60 K.W. motor-generator sets originally installed there are now two 200 K.W. rotary converters, with the necessary static transformers, and an improved switchboard for manipulating it. The principal point of importance is the ease and reliability with which such a system is shown to be operated. The efficiency of the system was shown by Mr. Parshall, by the working cost, to be satisfactory, although the efficiency of the machines in substations was not so high as would be the case with larger machines and large rotary converters. For a small tramway, however, the sureness of operation and the minimum of labor were of vastly greater importance than any small gain in efficiency.

Amateur Model-Making Competition at the Electrical and Kindred Industries Exhibition.

A committee consisting of Prof. Morris Loch, Dr. C. A. Doremus, Dr. W. E. Geyer and Mr. T. C. Martin has drawn up rules and regulations for an amateur model-making competition in connection with the Electrical Exhibition. Printed forms can be had from the management, 15 Cortlandt street, New York. The classes are given below, each class having prizes not to exceed \$50, and bronze medals, the exhibits to be judged by a committee of five well known men. It is believed that the contest will awaken general interest and elicit some beautiful and interesting apparatus. There are a great many young people and students in and around New York who find pleasure in handiwork of this character. The classes are as follows, and the exhibits must be entered a week before the Exhibition begins:

Class A.—Working model or actual machine of a dynamo-electric or electro-dynamic type; made by one or more boys under 21, so far as designing, lathe work, assembling and finishing are concerned.

Class B.—Instrument of precision, made by amateur or student; including galvanometers, resistance bridges, etc., etc.

Class C.—Practical application of electricity to communication, the assembling and finishing to have been the work of a single exhibitor.

Class D.—Ingenious application of electrical appliances to domestic, etc., uses, by an amateur under 18; none of the apparatus to be necessarily of home manufacture.

Class E.—Design or working drawing of an electrical appliance or installation, made within the past twelve months, by a student of a recognized chartered institution and bearing the instructor's certificate as to its bona fides.

Class F.—Design or instrument made by a teacher below the grade of college professor, for illustrating some electrical law.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

BOOK REVIEWS.

A POCKET DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By EDWIN J. HOUSTON, Ph.D. 950 pages. Published by the American Technical Book Company, 45 Vesey street, New York. Price, bound in leather, \$3; bound in cloth, \$2.50.

This work has been brought thoroughly up to date, and for clearness and conciseness is far in advance of any of the previous editions. The words, terms and phrases are arranged in alphabetical order, the definitions being given almost invariably in a few short concise sentences. No cross references are employed, the terms being arranged alphabetically in their natural order.

The value of this work will be appreciated when it is stated that it contains 11,000 electrical terms and words, or 6,000 more than the previous edition. In a growing science such as electricity, new words and terms are constantly appearing the meaning of which is not always clear. For speedy reference this work is invaluable, as owing to its size it can be carried in the pocket or kept ready at hand. As the dictionary was compiled solely with a view to furnishing concise definitions, technical students or those who desire a lengthy explanation will find it greatly to their advantage to obtain a copy of the complete fourth edition, containing encyclopedic matter and a system of cross references.

For the practical engineer and business man, however, the Pocket Dictionary fills a long felt want, as it is unquestionably the most complete and reliable electrical dictionary that has ever been published.

ALGEBRA MADE EASY. By EDWIN J. HOUSTON, Ph.D., and ARTHUR E. KENNELLY, Sc.D. 100 pages. Published by the American Technical Book Company, 45 Vesey street, New York.

This valuable little work, as is stated in the preface, was compiled for the purpose of elucidating the mathematical formulæ which appear in the pages of Prof. Silvanus P. Thompson's "Dynamo Electric Machinery" and "Polyphase Electric Currents." Although it contains nothing strikingly new, the principles of algebra, geometry, trigonometry and calculus are so simply yet clearly set forth that a person cannot help but grasp their meaning.

In carrying out the stated object of this publication, the authors have produced a work that is well worth studious perusal by the younger element of the electrical profession, and by some of the older members as well. The title of the book, in our opinion, should have been *Mathematics Made Easy*, for it covers almost the whole field in a lucid and admirable manner.

THE UNIVERSAL ELECTRICAL DIRECTORY (J. A. BERLY'S). Published by H. Alabaster Garhouse & Co., 4 Ludgate Hill, London. 1,100 pages. Price, 6s.

This valuable work as the title indicates is brought out at the beginning of each year for the purpose of enabling a person to find the address of any firm manufacturing electrical apparatus of any kind in Europe, America or in the colonies of Great Britain. The seventeenth edition, which has just made its appearance, contains 23,794 names of members of the electrical and kindred industries throughout the world.

This is 1,136 more names of individuals and firms than were contained in the 1897 issue of the Directory.

This last edition has been most carefully revised and brought up to the date of issue, the British alphabetical section now comprising 9,918 names, the Continental 7,872 names, the American 4,080 names and the Colonial section 1,924 names.

For facility of reference it is divided into four groups, namely, British, Continental, American and Colonial, which are again subdivided into alphabetical and classified sections. In the case of the British a geographical section is given, making in all nine subdivisions.

In addition to the new names incorporated in the

present issue, much financial information is given which should prove of value. Telegraphic addresses as well as local telephone numbers are also given, 70 pages having been added to the 1897 edition. This Electrical Directory is unquestionably the largest and probably the most comprehensive in the world.

The book is handsome in appearance and should prove invaluable to persons engaged in electrical and kindred industries. As the price is but \$1.25, it is well within the reach of all.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

Help to fight the Electrical Trust by subscribing for *ELECTRICITY*.

CANADIAN NOTES.

The Dominion Government will be asked to make an appropriation at the present session of Parliament for the extension of the Government telegraph system to the Yukon country. At the present time the Government telegraph line extends from Ashcroft, B. C., to Quesnelle, a distance of 225 miles. From the latter point to Telegraph Creek is 54 miles. The proposal is to build the section to Teslin Lake next season, reaching the Yukon in 1899. The cost is roughly estimated at \$500,000.

The C. P. R. Telegraph Company now proposes to stretch a copper telegraph wire from Montreal to Vancouver, B. C. It will then be possible to sit in the Montreal office and transmit messages to Vancouver direct. The wire to be used will weigh 300 pounds to the mile, and the total weight of copper wire to be used will be something like 450 tons. Work is expected to begin on the new line on the 1st of April, and to have the line completed and in working order by the 1st of June. Construction work will commence at the Montreal end. The copper wire to be used in the enterprise will alone cost in the neighborhood of \$250,000. The wire will be worked duplex.

At the next session of the Manitoba Legislature a local company will ask for a charter to build an electric railway from Winnipeg to St. Andrew's Rapids, and through the municipalities of Springfield, St. Boniface, Kildonan, St. Paul's and St. Andrew's. The company also proposes to construct sawmills, boats, telegraph and telephone lines.

From the plant which the West Kootenay Electric Light & Power Company is erecting at Bonnington Falls, B. C., it is expected that the transmission of power to the Rossland mines will be commenced this month. Bonnington Falls, where the power house is situated, lies about 11 miles below Nelson, B. C., on the Kootenay river. Water is conducted to the reservoir from the river by a canal 22 feet deep, cut out of rock for a distance of 640 feet. The two turbine wheels are attached directly to the generators. There are two generators, having together a capacity of 2,500 horse power. They operate at 180 revolutions per minute.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The June Meeting.

At a meeting held in Chicago last week many plans and suggestions were considered by the gentlemen invited to confer with President Insull upon the arrangements for the entertainment of visitors during the Convention of the N. E. L. Association, June 7, 8 and 9, at the Auditorium Annex, Chicago. The banqueting hall which has been secured for the session is one of the finest meeting rooms in the country. Space will be furnished for the exhibits in the hotel parlors and basement. There will be no general exhibit, the manufacturing and central station interests agreeing upon that point. President Insull announced that the plant of the Chicago Edison Company would be open to inspection at all times during the meeting, and that every facility would be afforded members to examine the practical workings of the system. He said that the company would also afford facilities for manufacturers to display their apparatus and specialties in actual operation in the Edison station. In other words, the Chicago Edison Company will keep open house for the Association during the Convention. Assurances were received from the street railway companies, and the elevated as well, that they would co-operate with the lighting interests in giving the visitors an idea of the advancement that has been made in the electrical development of Chicago since the last meeting in that city. It was also suggested that a visit to the drainage canal would be interesting, especially to the Eastern visitors. It is proposed to hold morning and evening sessions, devoting the afternoons to entertainments and sightseeing. This plan has been tried at the Edison Conventions and has proved satisfactory and popular. No definite action was taken

on any of the plans suggested, as it was deemed expedient to await the result of President Insull's conference with the Eastern representatives. Another meeting of the Chicago committee will be held on Thursday, March 24, at which time the views of the Eastern members will be presented and definite action taken.

COMMUNICATIONS.

The Warren Electric Company Receivership.

Warren Electric Manufacturing Co.,
Sandusky, O., Mar. 11, 1898.

Editor *ELECTRICITY*.

DEAR SIR: Having observed in the columns of the *Electrical Review* under date of March 9th an article stating that the president of our company at Sandusky, O., had put the concern in the hands of a receiver, and thinking that perhaps your journal might pursue the same course, we write to inform you that the article is misleading in every respect and not warranted by the wording of the press dispatches detailing the account of the receivership for the Chicago company. The enclosed letter states explicitly the facts and reasons for the action.

We trust that in case you make any allusions to the affair you will give a correct statement. Yours truly,

WARREN ELECTRIC MFG CO.
C. C. WARREN, Pres.

ENCLOSED LETTER.

Sandusky, March 11, 1898.

In explanation of the appointment of a receiver for the Warren Electric Co. of Chicago, Ill., I will state that it has no possible connection with the affairs of the Warren Electric Manufacturing Co. of Sandusky, Ohio, and was an action applied for by myself, and seemed the only method by which the following claims (the only ones against the company) could be protected: first, of certain bank paper on which I was personally an endorser; second, the claim of a member of my family solely for services; third, a claim I personally held for a considerable sum of money which I had advanced to the company; but most important, a receivership seemed to be the only means found by which H. J. Medbery of Mechanicsville, N. Y., the treasurer of the company, could be made to account for and disgorge the funds in his possession as treasurer, and compelled to apply the same to the reduction of the outstanding obligations named above.

The action was precipitated by an attempt on the part of Medbery and three others of like ilk to take actual possession of the legal organization of the Illinois company; to conduct it bodily to the State of New York; to make it the basis of a scheme by which they might manufacture the Warren Alternator in competition with the Sandusky Co., to whom the sole right to the Warren patents and the exclusive license to manufacture was granted by an assignment and contract more than a year and a half ago.

The legal right by which these four high-minded, self-constituted directors attempted to justify their nefarious scheme existed solely in the actual gift by myself of stock in the company of a sufficient amount, which, by manipulation, enabled them to capture four out of seven directors.

In extenuation of my act of placing stock in the hands of such persons, I can only say it must have been at a time when my benevolence vastly outweighed good judgment. Yours truly,

C. C. WARREN.

The Standard Diagrams.

The Chicago Electrical Association has published the report of the Association's Committee on Standard Diagrams in pamphlet form, with a view to having it in convenient shape for the use of electrical draughtsmen and patent attorneys. To cover the expense of printing, a nominal price of 10 cents each will be charged. Those desiring copies of this attractive pamphlet can procure them by addressing Mr. J. R. Gravath, 825 Monadnock Building, Chicago.

The General Electric Company owed on January 1, 1898, \$1,389,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Edison Electric Light Company having filed a petition in the U. S. Circuit Court at Pittsburg, Pa., asking an injunction and restraining order on the Doubleday Electric Company from manufacturing and selling an electric socket claimed by the plaintiff, the court issued the restraining order asked for pending a hearing of the case.

Judge O'Neill, at Eau Claire, Wis., on the 5th inst., made an order requiring R. E. Rust, receiver of the National Electric Manufacturing Company, to turn over all books and vouchers to the court. This is the result of a petition for a general overhauling of all receivership proceedings, involving about \$100,000.

The Barden-Sheets Electrical Construction Company, composed of E. T. Barden and Charles W. Sheets, filed a deed of trust in the county clerk's office at Galveston, Tex., on the 3d inst. The company's main office is in Houston, with a branch house in Galveston. The instrument, which is intended as a mortgage to better secure the payment of certain sums of money, conveys to J. M. Kilburn of Houston, in trust, all the stock of electrical supplies in both the main and branch establishments, to sell same within sixty days and complete the contracts now on hand. Out of the money received the trustee is to pay the expenses of the execution of this trust and then certain creditors in the order and amounts specified. Among the creditors specified are: Washburn & Moen Manufacturing Co., notes aggregating \$1,400; W. S. Edwards Manufacturing Co., note \$250; New York & Ohio Company, two notes, each \$200; Western Electric Company, account, \$39.95; Electrical Appliance Company, account, \$11.35; Interior Conduit & Insulation Company, account, \$107.70; General Incandescent Arc Light Company, account, \$254.26; Central Electric Company, \$100.

The National Conduit Company of New York has filed a complaint in the office of the clerk of the United States Circuit Court against Talcott H. Russell, receiver of the Connecticut Pipe Manufacturing Company of New Haven, Conn., alleging an infringement of a patent covering the manufacture of a specially constructed conduit pipe for the carrying of electric wires underground. The complaint alleges that the invention was made by Edward Phipps of New Haven and that he had assigned the patent to Edward S. Perot and James P. McQuaide, who formed the National Conduit Company which manufactures the conduits. The writ is returnable at the next term of the court.

Charles C. Warren of Sandusky, O., has asked the Superior Court, Chicago, to appoint a receiver for the Warren Electric Company and to dissolve the company. The capital stock is \$50,000 and the officers are Charles C. Warren, president; H. B. Warren, secretary, and Horace J. Medbery, treasurer. In January, 1897, the court is told, the company leased all its rights and certain patents to the Warren Electric Manufacturing Company of Sandusky, O. At that time the company had an outstanding indebtedness of \$12,500, of which \$8,500 was represented by notes indorsed by the complainant and H. J. Medbery as treasurer. The notes were payable to the First National Bank of Balston Spa, N. Y. The complainant also alleges that \$2,500 was due him on account of salary and money advanced for the payment of debts. According to the complainant, the total assets of the company will not exceed \$6,000 and the liabilities are \$12,000.

The report of the receiver of E. S. Greely & Co. of New York City, presented in court at New Haven on the 11th inst., shows \$104,096 available for dividends and allowed claims of \$173,726. There will be a dividend of about 60 per cent. and the business of the company will be closed up.

Nellie E. Judge, administratrix of Patrick J. Judge, has received a verdict of \$13,375 in her suit against the Narragansett Electric Lighting Company for \$15,000, in the Court of Common Pleas for Providence County, R. I., founded on a claim for damages as the result of her husband's death.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

THE NEWS.

What Is Going On in the Electrical World.

STREET RAILROADS.

Amesbury, Mass.—The board of selectmen has granted a franchise and location to the Amesbury & Hampton Street Railway Company.

Annapolis, Md.—A bill has been introduced in the Senate to incorporate the Princess Anne & Deal's Island Light, Power and Railway Company. The company proposes to construct an electric railway from Princess Anne to Deal's Island. The line is to be 20 miles long and will pass through St. Peter's, Dames Quarter and other villages in that thickly populated section. Thos. H. Brock, Wilmer O. Lankford, S. Frank Dashiell, Charles W. Hayman and H. Fillmore Lankford are named as the incorporators. The capital stock will be \$40,000. It is stated that the construction of the road will begin immediately after the passage of the bill.

Charleston, S. C.—The "News & Courier" states that the mission of Dr. J. S. Lawrence to New York in the interest of the Charleston & Seashore Railroad was successful, and the necessary money to build the road has been secured.

Corsicana, Tex.—Bright Tindall and associates have been granted a franchise for a street railroad over all the streets of the city, two miles of the lines to be completed and in operation in twelve months.

Dayton, O.—At present there are six different companies asking for rights of way into this city. Four of the companies are the Dayton & Western which is building a road from here to Eaton, a distance of 25 miles west; the Dayton, Springfield & Urbana; the Miami & Piqua, and the Dayton, Troy & Piqua. These companies are backed mostly by foreign capitalists. The county commissioners have granted a franchise and right of way through this county to the Dayton, Troy & Tippecanoe Electric Railroad Company for a period of 25 years. The route is over the new Troy pike from North Dayton to Chambersburg and Vandalia in this county and thence to Tippecanoe and Troy in Miami County.

Delaware, O.—The Delaware Street Railway has been sold by the receiver to B. W. Brown and associates for \$24,000, about one-third of the original cost.

Denver, Col.—Negotiations for the consolidation of the Denver Consolidated Tramway Company and the Denver City Railroad Company have been going on for some time, and the indications now are that the consolidation will be effected at an early day.

Huntington, N. Y.—The Long Island Railroad Company has purchased the Huntington Railroad and will change it into a trolley road.

Kenosha, Wis.—The city council has passed an ordinance which welds the last link in the most extensive interurban electric railroad line in America. Within a few months it will be possible for a trolley car to travel uninterruptedly from Chicago to Green Bay, Wis., a distance of 201 miles. The electric line parallels the Milwaukee Division of the Chicago & Northwestern Railroad.

Lewiston, Me.—The "Journal" advocates the building of a trolley road around Lake Auburn, and says everybody is agreed that it would pay except possibly the owners of the Lewiston & Auburn Electric Street Railway Company.

Lowell, Mass.—The bill before the Legislature for the incorporation of the Lowell, Acton & Marlborough Street Railway Company names the following as incorporators: Louis P. Howe, Herbert E. Bradford, Patrick F. Sullivan, Henry M. Chamberlain, Oren P. Walker, James F. Bigelow, Abel G. Haynes, Henry S. Perham, Luther Conant and William N. Davenport.

Mamaroneck, N. Y.—The local board of trustees has granted a hundred-year franchise to the Tarrytown, Mamaroneck & White Plains Electric Railway Company, which gives the company the right to operate a trolley line over the various streets in this village. It also gives it the privilege to carry freight between certain hours of the day. This company now operates a line from Tarrytown to White Plains and this franchise will give it a direct route from the Hudson River to Long Island Sound.

Newark, N. J.—The city council has passed the ordinance giving the Consolidated Traction Company the right to lay tracks in Chestnut, Miller and Vanderpool streets.

New York.—The Metropolitan Street Railway Company has completed the conduit work on the Madison Avenue line, and cars operated by the underground trolley now run from the City Hall to the terminus at 135th street.

New Haven, Conn.—The "Register" says: "Capitalists from New York, Boston and Providence, representing a syndicate who operate several electric railways in New England, have been in consultation with the corporators of the People's Tramway Company of Danielson with reference to the purchase of its charter and the building of an electric street railway connecting the towns of Putnam, Killingly, Brooklyn and Plainfield. If the proposition of the corporation is accepted, the road will be built at once from Putnam to Danielson, and later from Danielson to Moosup via Brooklyn."

Portsmouth, N. H.—The stockholders of the Ports-

mouth & Dover Railroad at a meeting on the 7th inst. voted to equip the line with electricity.

Richmond, Va.—The Governor has signed the bill allowing the Richmond & Petersburg and the Petersburg Railroad Companies to consolidate under the name of the Atlantic Coast Line Company.

LIGHTING PLANTS.

Chicago, Ill.—Twenty-two hundred arc lights will be installed in the city of Chicago during 1898. Recently the city council finance committee voted \$150,000 for the extension of the municipal lighting system and a separate fund for maintenance. It is announced now that the entire street lighting department will be turned over to City Electrician Ellicott. If this project is carried out Mr. Ellicott will have charge not only of the electric lights, but of all the gas lights as well. With the installation of the electric lights, several times that number of gas lamps will be discontinued, and it is the intention of Mayor Harrison and Commissioner McGinn to put all of this work in the hands of one man if possible.

Cloverdale, Cal.—A fire at the electric light works here on the 1st inst. caused damage to the plant estimated at \$7,500.

Columbus, O.—Sealed proposals will be received by James A. Fanning, the clerk of the Board of Public Works of the city of Columbus, until 12 o'clock noon, March 24, for furnishing the labor and materials for the construction of an electric light plant for the city, in accordance with the plans and specifications on file with and to be obtained from H. M. Lyman, superintendent of lights, City Hall, Columbus.

Dodgeville, Wis.—The city council has granted a ten-years' lighting franchise to W. H. Earl of Chicago, the cost of arc lights to the city to be \$100 a year.

Hodgenville, Ky.—A company of Sydney, O., about to establish a wood factory in this place, will also put in an electric light plant for the town.

Hoboken, N. J.—The board of freeholders of Hudson County will receive bids until 4 P. M. on the 21st inst., for lighting the Weehawken branch of the Hudson Boulevard for a period of sixty days, using the wires and lamps now in position; the bids must be per light per diem.

Lancaster, Pa.—The Lancaster Electric Light, Heat & Power Company, which has the contract for lighting the streets of this city for the ensuing five years, is erecting an additional power plant for the purpose of establishing a commercial system. The company will erect a large building, into which all of the wires from their Slackwater and Rock Hill power plants, on the Conestoga creek, will be run, and from which direct current will be issued to various points. The company proposes lighting the villages about Lancaster and the Millersville State Normal School, as well as establishing a commercial system.

Macon, Ga.—The Atlanta journals in noticing the electric headlights placed as experiments on two of the locomotives of the Seaboard Air Line Railroad, stated that they were the first used in the South. The "Telegraph" says "Atlanta is mistaken. The Georgia Southern & Florida Railroad has been using electric searchlights on its engines for six years with the utmost satisfaction."

McKeesport, Pa.—The McKeesport Electric Light Company has purchased the plant of the Duquesne Heat, Light & Power Company and will furnish light and power to both towns. The capacity of the McKeesport plant has just been greatly increased, and the company capitalized at \$150,000. Horace Crosby is president and Homer Stewart secretary.

Mt. Pleasant, Ia.—This town doesn't find municipal ownership all it promised to be. The operating expenses of the electric light plant for January exceeded the receipts by \$150.

Omaha, Neb.—Consulting Electrical Engineer Steiringer is busily engaged in working out the details for the lighting and ornamental illumination of the Exposition grounds. Mr. Steiringer says that he has a more enthusiastic conception of the possibility of fine and entrancing effects in the buildings and grounds than even that which he had at first. "The setting up," he says, "is superior in every way to anything heretofore projected in this line."

Plainwell, Mich.—The town council has adopted a resolution in which they say it is expedient for the village to buy, or construct, and operate an electric light plant.

Sac City, Ia.—At the recent special election this town voted by a large majority in favor of putting in an electric light plant.

Stromsburg, Neb.—The business men of this place have come to the conclusion that an electric light plant would add to the prosperity of the town.

Suffolk, Va.—The town council has instructed a committee to visit Greensboro' and High Point, N. C., inspect the electric-light plants at those places, and report as to the advisability of the town of Suffolk putting in a similar plant.

Tooele, Utah.—The people are discussing a proposition to bond the town for \$10,000 in order to get an electric light plant started. The matter, it is believed, will go through.

Ventura, Cal.—The preliminary steps have been taken by the town trustees for a special election to bond the

city for an electric light plant to cost \$20,000. The private plant here was burned on January 20th.

TRANSMISSION PLANTS.

Helena, Mont.—In a few weeks the big turbines at Canyon Ferry will begin to revolve and the electrical power generated there will be transmitted to this city and to East Helena, the distance being about 17 miles. J. T. Fanning, of Minneapolis, the consulting engineer, who designed the dam, power house and hydraulic machinery at Canyon Ferry, has inspected the plant and says it will compare with any transmission plant in the country with the possible exception of that at Niagara Falls.

Pittsfield, Mass.—The present owners of the woolen mill property at Glendale propose to utilize the water power attainable at that point in the operation of an electric plant to furnish motive power for an extensive electric railroad system reaching from Pittsfield through Richmond and West Stockbridge to Great Barrington, and also to supply power, light and heat to firms in the central and southern part of the county. A company is to be organized and incorporated under the Massachusetts law with a capital of \$50,000.

Randolph, Utah.—Salt Lake parties have been examining Swan Creek with a view to selecting a favorable site for an electric plant from which to light all the larger towns in Bear Lake Valley, that is, Paris, Montpelier, Bloomington, St. Charles, Laketown, Garden City and others.

Shell Lake, Wis.—The business men are considering plans for electric power and light for this city. An effort will be made to secure a water-power on Yellow river, four miles distant, where a large dynamo will be placed and the current transmitted to Shell Lake.

Waterville, Me.—The Waterville & Fairfield Electric Light & Power Company having failed to meet the requirements of the conditional charter granted to the Union Gas & Electric Company, the latter's charter has been decreed by the court to be in full force. This company has in view the improvement of the valuable water power privilege of the Messalonskee stream. Its purpose is to furnish gas and electricity to Waterville for heating, lighting and power.

COMPANY MATTERS.

New Britain, Conn.—The Otis & McKirdy Co. has been organized in this city to manufacture electric specialties and novelties.

Pittsburg, Pa.—It is reported that the Westinghouse Electric & Manufacturing Company has been asked to bid on a contract for establishing a general electric-lighting and power plant in Valparaiso, Chili. The contract would require about \$150,000 worth of material.

Richmond, Va.—The bill to incorporate the Washington & Fairfax Railroad Company has passed the Senate. The bill to authorize the town of Farmville to grant a franchise to street railway companies has passed the House.

Toronto, Can.—The Toronto Electric Motor Company have notified the Mayor that they have amalgamated with the Thomson Electric Company of Hamilton, and that the Hamilton factory of the latter will be moved to Toronto by the first of May.

FIRES, ETC.

Corbin, Ky.—The local electric light plant was totally destroyed by fire on the 4th inst. Mr. Hamilton, the general manager, says it will be rebuilt at once.

Independence, Mo.—The depot of the Kansas City & Independence Electric Line in this city has been burned to the ground. Loss about \$20,000. The road is operated by the Metropolitan Street Railway Company of Kansas City, Mo.

Lakeview, Ore.—The recent fire that destroyed the residence of J. A. Anthony on Cottonwood creek, about eight miles from here, also destroyed the electric light plant that furnished lights for Lakeview.

Pittsburg, Pa.—The large switchboard in the Westinghouse Electric Works at Brinton was burned a few days ago by carrying too heavy a current and the automatic circuit breakers refusing to work.

PERSONAL AND MISCELLANEA.

Frank B. Flynn has been appointed chief engineer of municipal lighting plants in Chicago. He had been connected with the Chicago Fire Department fourteen years.

The Milwaukee "Wisconsin" says: "The Port Huron (Mich.) Electric Railway is experimenting with a new ball-bearing truck on one of its motor cars, the product of the inventive genius of John Deloyia of this city. This is the first attempt of the ball-bearing principle being applied to electric street cars for the purpose of reducing resistance to a minimum. Railway managers throughout the country are watching the experiment with interest. A ball-bearing trolley has also been perfected and is being given a trial on the Port Huron Electric Railway."

James A. Stratton, secretary and treasurer of the Birmingham Railway & Electric Company, died recently at Birmingham, Ala. Mr. Stratton was born in Aurora, Ind., and was for some time cashier in a bank in that city. He went to Birmingham several years ago and became bookkeeper in a large establishment there. He was one of the organizers of the Birmingham Railway

& Electric Company, and as its secretary and treasurer contributed much to its success. He was unmarried.

The Philadelphia city councils' electrical committee has reported favorably upon the ordinance granting permission to the Time & Weather Service Company to erect and maintain meteorological and time columns at the corners of certain streets in that city. The columns will be constructed of metal of ornamental design, and will be of a width not exceeding two feet six inches and of a height not exceeding ten feet six inches, and the weather vane and time ball supported on the top will be of a height not exceeding six feet nine inches. In the four corners of the structure space will be reserved for barometers and thermometers, which will be first tested for accuracy by the United States Weather Bureau. Telegraphic instruments will be placed in a space 18 x 7 inches for the official forecast, which will be forwarded from Washington at 9 A.M. The company expect to make the columns remunerative by advertising panels placed neatly in the structure.

The Civil Service Commission announces that on April 5 an examination will be held in Washington, D. C., for the position of telephone linemen in the United States life saving service at a salary of \$85 a month. The examination will consist of a light educational test, together with practical questions; and, in addition thereto, applicants will be graded upon their experience and character as workmen. The general qualifications of a telephone lineman should be as follows: He should be able to read and write, should have a fair knowledge of simple arithmetic, should be able to prepare estimates for material and bills for same, to select and lay out routes for telephone lines, to construct and repair telephone lines, to lay and repair submarine cables, to put up telephone and other instruments used on telephone lines and to establish connections; to make ordinary repairs to telephones and instruments and to test lines, cables and instruments; to locate trouble on lines and in cables. He should be familiar with telephone material, and with the mechanism of telephones, call bells and other telephone instruments and apparatus. He should be able to do all work usually required of a telephone lineman, and should be possessed of such information as will enable him to intelligently and satisfactorily perform the duties of the position. He should have had at least five years' experience as a telephone lineman immediately preceding his application; and he would be required to state when and where such experience was had. He must not be under twenty five years nor over forty years of age. He must be physically strong, and of good health, active and able to stand the exposure incident to his employment on the coast.

RECENT COMPANY ELECTIONS.

Canton-Massillon Electric Railway Company, Canton, O.—President and treasurer, W. A. Lynch; vice-president, C. A. Gates; secretary A. J. Underhill; general manager, H. C. Fogle; directors: the officers and J. W. McClymonds, C. M. Russell and R. A. Miller.

Hestonville, Mantua & Fairmount Park Passenger Railroad Company, Philadelphia.—President, John B. Parsons, general manager of the Union Traction Company, to succeed Isaac Blum; secretary and treasurer, D. C. Golden, to succeed Mr. Benson. Mr. Blum was elected a director, taking the place of Lewis A. Riley who retired.

Mount Mansfield Electric Railroad Company, Stowe, Vt.—President, A. H. Soudan; vice-president, P. D. Pike; manager, C. J. Shepard; clerk, L. C. Moody; treasurer, F. O. Burt; directors: A. H. Soudan, C. J. Shepard, G. E. Moody, C. L. McMahon, P. D. Pike and A. H. Bartlett.

Pine Bluff Light & Water Company, Pine Bluff, Ark.—President, Frank G. Bridges; vice-president and treasurer, C. H. Triplett; directors: R. M. Knox, F. G. Bridges, M. H. Johnson and C. H. Triplett.

Port Carbon Electric Light Company, Pottsville, Pa.—President, G. W. Heebner; treasurer, Robert Allison; secretary, F. A. Allison; manager, William Brenner.

West Newton Northern Railway Company, West Newton, Pa.—Directors: W. W. Patterson, Homestead, president; J. O. Tosh, Pittsburgh; F. M. Null, Dawson; G. M. Suter, Sutterville; Dr. J. N. Weddell and T. F. Van Kirk, West Newton. The proposed line is a trolley, to extend from Bellevernon on the Monongahela to Irwin on the Pennsylvania Railroad.

COMMERCIAL PARAGRAPHS.

Electric car heaters are coming more and more into general use. The H. W. Johns Manufacturing Company, 100 William street, New York, have recently brought out a heater of this nature that embodies all the requirements. It is simple in construction, durable, efficient, and above all extremely economical. These heaters are under thorough control and may be so regulated by means of a knife-blade regulating switch located at one end of a trolley car as to enable three degrees of temperature to be obtained. This well-known concern not only manufactures electric car heaters, but trolley line insulating materials, vulcanized controller parts, commutator rings and various other high grade apparatus. Any one contemplating purchasing apparatus of the above nature would do well to write the H. W. Johns Co. for their illustrated catalogue and pamphlet describing their products. Considering the excellent quality of their wares their prices are extremely reasonable.

The Eureka Tempered Copper Company, whose advertisement appears in this issue of ELECTRICITY, has recently moved from 511 and 513 West 18th street into more comfortable and spacious quarters at 107 Liberty street, New

York. We understand that this well-known firm has just closed an important contract for twelve months with one of the largest manufacturers of electrical machinery in the country, and besides has several other important contracts on hand. The large amount of work this company has at the present time speaks well for the quality of its product. The Eureka Tempered Copper Company while making no claims to having discovered the lost art of treating copper, have however been enabled by its process to not only cast pure copper solid without alloys, but also to temper or harden it sufficiently for all mechanical uses without in any way destroying the fibrous qualities of the native metal. The company makes a specialty of the manufacture of commutator segments, both cast and drop forged, dynamo brushes, trolley wheels, bearings, springs and wire, besides copper and brass castings of every description, and carrying in stock at all times a large amount of standard goods, both finished and unfinished, it is always prepared to ship all orders at short notice.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

A Different Company Altogether.

It seems that some company which has a name similar to ours has been unfortunate enough to pass into the hands of a receiver. We, of course, sympathize with our namesake, but desire to inform the trade that while we have troubles this is not one of them, and that we are still selling anti-trust lamps in large quantities.

THE WARREN ELECTRIC & SPECIALTY CO.,
Warren, O.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address: Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

The Electric Appliance Company of Chicago are anxious to emphasize the fact that they are agents for a commercially successful electric soldering iron. They state that they have now been handling the irons of the American Electrical Heater Co. for about two years, and that in not a single case have they been unable to secure satisfactory results. They are willing to show their confidence in these goods by guaranteeing every iron they send out to do its work in an entirely satisfactory manner.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

INCORPORATIONS.

The Citizens' Electric Light & Power Company, Gonzales, Tex.—to supply electric light, heat and power to the public. Capital stock, \$5,000. Incorporators: A. Kleine, Jr., W. B. Houston, Charles Berringer, L. C. Brunner and J. D. Sayers, Jr.

The Hayden Electric & Mining Company, Colorado Springs, Col.—to operate in El Paso and Fremont counties. Capital stock, \$250,000. Incorporators: A. B. Heath, E. J. Eaton and E. F. Wright.

The Warwick Valley Light & Power Company—to operate in the towns of Warwick and Chester, N. Y. Capital stock, \$25,000. Directors: George Whitman, Morris, Frank Barber and Helen Barber, Liberty, N. Y.

The Hempfield Electric Light, Heat & Power Company, Jeannette, Pa. Capital stock, \$10,000.

The Rock Hill Water, Light & Power Company, Rock Hill, S. C. Capital stock, \$50,000. Incorporators: A. R. Smith, David Hutchinson, R. T. Fervell and James M. Cherry.

The Port Jervis Light & Power Company, Port Jervis, N. Y. Capital stock, \$50,000. Directors: William P. Richardson, C. J. Field, George A. Elston and C. J. Van Inwagen.

The Cumberland Street Railway Company, Woonsocket, R. I.—to build and operate a street railway from Cumberland Hill to Lonsdale. Capital stock, not to exceed \$100,000. Incorporators: Andrew J. Currier, William H. Tobey, P. J. Gaskin, C. H. Wood, C. F. Wood, A. B. Chase, Charles Dexter, John F. Clark, Cyrus Taft, W. H. Bolster, John Barnes and John Ryan.

The Kentucky Electric Company, Ludlow, Ky.—to furnish electric street lighting for Ludlow. Capital stock, \$30,000. Incorporators: John Devere and Luke Lilly of Cincinnati, J. H. Gueme of Ludlow. The company has al-

ready secured the contract to furnish electric street lighting for Ludlow.

The People's Light & Power Company, Crestline, O.—to furnish light and power. Capital stock, \$30,000. Incorporators: Roy C. Foster, William B. Bolton, A. E. Barridge, J. Chinnock and W. H. Pelton.

The Eastwood & East Syracuse Railroad Company, Syracuse, N. Y.—to operate an electrical road in the villages of Onondaga County mentioned in its title. Capital stock, \$200,000. Directors: A. J. Helden, J. A. Secley, C. M. Warner, G. E. Warner, Edward Joy, A. P. Fowler, F. J. Webb, M. P. Pierce and C. S. Carroll, of Syracuse.

The Electrical Engineer Institute of Correspondence Instruction, Jersey City, N. J. Capital stock, \$50,000. Incorporators: Herman A. Strauss, Joseph Weitzler and Thomas O. Martin, New York, and Edward Ruth, town of Union, N. J.

The Otis & McKirdy Company, New Britain Conn.—to carry on the manufacture of electric specialties. Capital stock, \$10,000, of which \$2,000 has been paid in. Incorporators: Charles H. McKirdy, Fannie W. McKirdy and Charles H. Otis.

The Binghamton Electrical Construction Company, Binghamton, N. Y. Capital stock, \$5,000. Directors: Charles F. Terhune, L. M. Blanding and R. E. Prince, Binghamton.

The Trenton Light & Power Company, Trenton, Ill.—to operate a light, heat and power plant. Capital stock, \$8,000. Incorporators: J. C. Eisenmayer, Louis Retman and Frank Leonhard.

The Winstboro Electric Light & Power Company, Winstboro, S. C.—to put in an electric light plant for 750 incandescent lamps. Capital stock, \$3,000.

The Charleston Light & Water Company, Charleston, S. C. Capital stock, \$50,000, with privilege of increasing to \$3,000,000. Incorporators: Samuel Lapham, Charles R. Volk, W. H. Welch, A. G. Rhett, H. F. Bremer, George I. Cunningham and others.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 8, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 600,134. Electric Locomotive. Harry Bitner, Chicago, Ill. Filed June 19, 1896.
- 600,212. Trolley-Wire System. William J. Kauffman, Elias W. Conkell and Orrin F. Kauffman, Canton, O. Filed June 5, 1897.
- 600,232. Means for Arresting Motion of Electric Cars. Wilbur C. Anderson, West Hoboken, N. J. Filed Aug. 30, 1895. Renewed Oct. 23, 1897.
- 600,278. Automatic Switch for Railways. Howard F. Eaton, Quincy, Mass. Filed July 13, 1896.
- 600,341. Electric Railway. Louise Scherpe, St. Louis, Mo., administratrix of John F. Scherpe, deceased. Filed Aug. 12, 1897.
- 600,183. Automatic Car Fender. Oliver E. Stahl, Baltimore, Md. Filed Oct. 29, 1897.
- 600,224. Safety-Fender for Street-Cars. William B. Heywood, Guadalupe, Cal. Filed Sept. 17, 1897.
- 600,378. Car-Fender and Brake. Emery E. Rice, Charlerol, Pa. Filed April 1, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 600,277. Electric-Arc Lamp. James H. Duncan, San Francisco, Cal., assignor to Robert Bruce Elder, same place. Filed July 13, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 600,135. Electrical Surgical Engine. Arthur W. Browne, Prince's Bay, N. Y., assignor to the S. S. White Dental Manufacturing Company, Philadelphia, Pa. Filed Oct. 19, 1897.
- 600,228. Polyphase-Current Transformer. Carl Kurda, Nuremberg, Germany, assignor to the Elektrizitäts Actien-gesellschaft, vormals Schueckert & Co., same place. Filed Nov. 5, 1896.
- 600,336. Automatic Regulator for Electric Currents. Joseph D. C. Chateau, Paris, France. Filed July 10, 1897.
- 600,446. Multiple Energizer Momentum-Engine. Benjamin C. Poie, Camden, N. J. Filed May 2, 1887.

ELECTRIC HEATERS, ETC.

- 600,285. Electric Heater. Richard J. Holland, New York City. Filed Dec. 24, 1896.
- 600,417. Electric Heater. Edward E. Gold, New York City. Filed Aug. 12, 1897.

SIGNALS AND SIGNALING APPARATUS.

- 600,384. Signaling Apparatus. Vibe K. Spicer, Kenilworth, Ill., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed April 27, 1897.
- 600,385. Signaling Apparatus. Vibe K. Spicer, Kenilworth, Ill., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed July 13, 1897.

MISCELLANEOUS.

- 600,230. Electrotherapeutic Exercising Apparatus. Abraham Martin, Paris, France. Filed Nov. 23, 1897.
- 600,265. Electrical Measuring Instrument. Adrian H. Hoyt, Penacook, N. H. Filed July 2, 1897.
- 600,290. Therapeutic Electrode. John S. Muir, San Francisco, Cal. Filed Aug. 24, 1897.
- 600,346. Insulating-Connector. Herbert E. Pearce, Brooklyn, N. Y., assignor to Fannie Pearce, same place. Filed May 18, 1897.
- 600,380. Galvanic Apparatus. George H. A. Schaefer, Buffalo, N. Y. Filed Jan. 7, 1898.
- 600,383. Electrically-Operated Brush. Alfred Sherwood, Topeka, Kan. Filed March 1, 1897.
- 600,397. Arm for Telegraph-Poles. Lee Anderson, Paris, Tex., assignor of one-half to Wallace B. Howard and Alex. Staggs, same place. Filed April 20, 1897.
- 600,457. Electrical Battery. Nathan B. Stubblefield, Murray, Ky., assignor of one-half to William G. Love, same place. Filed Oct. 24, 1896.
- 600,475. Electrical Insulator and Method of Making Same. John W. Boch, East Liverpool, O. Filed Oct. 23, 1897.

DESIGN.

- 28,355. Insulator. Louis McCarthy, Boston, Mass. Filed Jan. 18, 1898.

Help to Fight the Electrical Trust by subscribing for **ELECTRICITY**.

TELEPHONE AND TELEGRAPH.

Gen. Greely, the Chief Signal Officer, has written a letter to the Secretary of War, calling his attention to the omission from the Sundry Civil bill as reported to the House of the estimate of \$20,000 for cables to connect electrically the fortifications in the harbors of New York, Boston and Philadelphia. In his letter he says: "For seven consecutive years the Chief Signal Officer has unavailingly recommended the importance of this matter, reciting the fact that some of our most important defences can only be reached by messenger. The destruction of the military cables between Alcatraz, Angel Islands and the mainland long since left the fortifications in San Francisco harbor isolated and entirely unconnected electrically, and Fort Warren, in Boston harbor, is also without reach by telephone or telegraph. In New York harbor it is true that several posts can communicate with each other over circuitous commercial routes, but such complicated methods, inadequate in peace even, would inevitably break down in case of actual hostilities."

The consolidation of the Cumberland Telephone & Telegraph Company and the Great Southern Telephone & Telegraph Company has been ratified by the stockholders of both companies. The officers of the consolidated concern are: James E. Caldwell, president and general manager; William Litterer, vice-president; Leland Hume, secretary and assistant general manager; Col. A. W. Crandall, superintendent; T. D. Webb, treasurer. Executive Committee: W. W. Berry, William Litterer, A. G. Sharpe, V. E. Shwab and James E. Caldwell. Board of directors: James E. Caldwell, Nashville; Col. A. G. Sharpe, Atlanta; V. E. Shwab, Nashville; M. J. Smith, Nashville; R. M. Barton, Chicago; William Litterer, Nashville; W. W. Berry, Nashville; Henry Sperry, Nashville; George G. Hall, Cincinnati; F. W. Cook, Evansville; George R. Knox, Nashville; W. H. Woolverton, New York.

A bill of sale given by the New York State Telephone Company to the Automatic Telephone Service Company of Buffalo, for a consideration of \$1, has been filed at the county clerk's office in Utica, N. Y. It transfers 845 shares of stock of the Utica Telephone Company, 30 shares of stock of the Oneida Telephone Company, 336 contracts with subscribers for service in Utica, 600 contracts with subscribers in Johnstown and Gloversville, contracts with subscribers in Rome and elsewhere, merchandise, supplies, etc., in Rome and Utica, and other assets and property belonging to the New York State Telephone Company, as collateral and continuing security for royalties due and to become due to the Automatic Telephone Service Company of Buffalo.

At the annual meeting of the Hudson River Telephone Company the following officers were elected: President, Selden E. Marvin; vice-president, James H. Manning; secretary and auditor, Walter B. Butler; treasurer, James J. Fitzsimmons; general manager, Henry E. Hawley. The gross receipts for the year were \$221,121.34, and the net revenue was \$13,917.22. Ten exchanges were opened. General Manager Hawley reported that 38 exchanges are operated by the company, and that the aggregate number of subscribers is 6,488, an increase of 1,031 for the year.

A telephone company has been organized at Eureka, S. D., with the following officers: President, William Robb; vice-president, E. G. Kennedy; secretary, C. N. Herriet; treasurer, Walter Poehler; general manager, J. W. Gabin. Work will begin in a short time. It is confidently expected that the Dakota Central Telephone Company will extend its limits to Eureka the coming season, thus connecting Ipswich, Bowdle, Rescue, Eureka, Leala and other towns with Aberdeen, S. D.

The officials of the New York Board of Trade say they are determined to secure some relief from the present telephone monopoly. If their efforts fail at this session of the Legislature, a different kind of campaign will be begun, with Vice-President R. M. Walters and Committee-man Rupert A. Ryley in charge. A number of merchants and manufacturers will combine with the officers of the municipal government and start a new telephone company in rivalry with the present monopoly.

Assemblyman Wicke has introduced a bill in the New York Legislature providing that within one year all telegraph, telephone, and electric light wires in New York and Buffalo shall be placed underground at the expense of the corporations operating them under the direction of the Commissioner of Highways or Board of Public Works.

A number of citizens met recently at the Opera House in Humboldt, Neb., and took steps toward organizing a company to put in and operate a local telephone exchange. It was decided to issue stock to the extent of eighty shares of \$50 each, to raise money for putting in the system.

At the annual meeting of the Commercial Cable Company, New York, the following officers were elected:

President, J. W. Mackay; vice-president and general manager, G. G. Ward; vice-presidents, C. R. Hosmer, A. B. Chandler and C. H. Mackay; treasurer, E. C. Platt; secretary, Albert Beck; assistant secretary, J. O. Stevens.

The act for the taxation of telegraph, telephone and express companies in the State of South Carolina, passed at the recent session of the Legislature, makes it obligatory upon these companies to furnish to the Comptroller General of the State a sworn annual statement of their capital, property of all kinds, mortgages, transactions, equipment, operation, etc.

The District of Columbia Appropriation bill was passed by the Senate on the 8th inst. The bill limits the charge for telephones in the District to \$50 a year on a separate wire, \$40 when there are not more than two on a wire, \$30 when not more than three on a wire and \$25 when there are four or more on the same wire.

A bill has been introduced in Congress for the erection and operation of a postal telephone system in Washington to be under the control of the Postmaster General. The sum of \$100,000 is asked for this purpose, which would be the means of connecting all the public buildings and Government offices in the city.

The Boston Post states that more than 4,000 telephone subscribers in the Boston district alone have signed the petition to the Legislature for the enactment of the Post telephone bill for a reduction in rates. Boston is the home of the Bell monopoly and it has organized a strong opposition to the bill.

The Automatic Telephone Company of Amsterdam, N. Y., is about to make a reduction in its rental charges. Hereafter telephones in business places will be \$2.50 a month instead of \$3, and residence telephones \$1.50 instead of \$2 as heretofore.

The Bell Telephone Company has cut rates in the Saginaw Valley to \$12 per year for residence 'phones. The Valley Company will probably meet this price as soon as it begins operations.

The city council of Owosso, Mich., refused to accept the offer of six free telephones for three years from the Bell company.

The Farmers' & Merchants' Telephone Company's lines between Quincy, Barry and Pittsfield, Ill., were thrown open to the public on the 8th inst.

F. A. Smart of the State Telephone Company has secured orders for nearly 100 'phones at Lapeer, Mich. The line will be built in May.

The council of St. Paul, Minn., has passed the Minnesota Central Telephone Company's long distance franchise.

New Companies Incorporated.

The Monroe Telephone Company, Woodfield, O. Capital stock, \$1,000.

The Western Telephone Manufacturing Company, Chicago, Ill. Capital stock, \$2,000. Incorporators: M. B. Kennedy, W. A. Bisland and S. C. Platt.

The Versailles Telephone Company, Versailles, Ky.—to establish a telephone system. Capital stock, \$5,000. President, B. B. Smith; vice-president, Charles S. Powell; secretary-treasurer, W. R. Proctor.

The Wilson Spring & Telephone Company, Wilson, W. Va. Capital stock, \$100,000. Incorporators: Joseph T. Stubbs, Vernon M. Pierce, Prentice H. Manning, Joseph Hinckley and George G. Hackett.

The Bucyrus Telephone Company, Bucyrus, O. Capital stock, \$30,000.

The Mississippi Valley Telephone Company of Minneapolis, Minn. Capital stock, \$1,000,000.

The Hays City Telephone Company, Hays City, Kan. Directors: I. M. Yost, C. M. Warren, J. H. Ward, E. D. Yost and Otto Swaller.

The Phoenix Telephone Company, Phoenix, N. Y.—to operate in Phoenix and Fulton and adjoining towns. Capital stock, \$10,000. Directors: C. F. Loomis, F. K. Avery and A. D. Merry, Phoenix; Joseph K. Whitaker and Lenox Smith, New York City; E. E. Summey, Syracuse; C. H. Brace, Baldwinville.

The Crookston Telephone Company, Crookston, Minn.—to connect Crookston, East Grand Forks, Red Lake Falls and other towns by telephone. Capital stock, \$10,000.

The Iowa & Nebraska Telephone Company has filed articles of incorporation at Lincoln, Neb. Capital stock, \$50,000. President and secretary, W. W. Pritchett; treasurer, B. B. Van Stunberg.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Mar. 14:						Hartford Conn.—Mar. 14:					
Albany Ry. Co.....	100	2,000,000	\$1,750,000 1% Q. Feb. '98.	133 1/2	184 1/2	Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000 3% S. Jan., '98.	140	--
Troy City Railway Co.....	100	2,000,000	2,000,000 1% Q. Dec. 10, '97.	72	--	Hartford & West Hartford RR.....	100	1,000,000	247,000	--	--
Traction Co. (Saratoga).....	100	50,000	50,000	--	--	Holyoke Mass.—Mar. 14:					
Allentown, Pa.—Mar. 14:						Holyoke Street Ry. Co.....	100	400,000	400,000 4% A. Jan., '98.	200	205
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	--	80	Hoboken, N. J.—Mar. 14:					
Bridgeport, Conn.—Mar. 14:						North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000 8% S. 1892.	70	--
Bridgeport Traction Co.....	100	2,000,000	2,000,000 1% Aug., '97.	45	60	Indianapolis, Ind.—Mar. 14:					
Baltimore, Md.—Mar. 14:						Citizens' Passenger Ry.....	....	5,000,000	5,000,000	25	26
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000 5% S. July 2, '97.	72	73	Lancaster, Pa.—Mar. 14:					
Baltimore Consolidated Ry. Co.....	25	10,000,000	9,177,000 2% S. Jan. 15, '98.	22 1/4	22 1/4	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	--	--
Central Ry. Co. of Baltimore City...	50	800,000	800,000 6% A. Dec., 1897.	80	82 1/2	Lancaster & Col. Electric Ry.....	....	87,500	.....	--	--
Boston, Mass.—Mar. 14:						West End Street Railway.....	....	.....	.....	--	--
New England Street Ry.....	25	5,000,000	1,081,925 1% Q. Jan. 15, '97.	--	--	Louisville, Ky.—Mar. 14:					
North Shore Traction Co.....com.	100	4,000,000	4,000,000	10	20	Louisville Ry.....com.	100	4,000,000	3,500,000 1 1/2% S. Oct., '97.	85	84
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000 6% S. A. & O.	77	78	Louisville Ry.....	100	2,500,000	2,500,000 2 1/2% S. Oct. 1, '97.	94	96
West End Street Ry. Co.....com.	50	1,000,000	9,085,000 1% S. Oct., '97.	80 1/4	81	Minneapolis, Minn.—Mar. 14:					
West End Street Ry. Co.....8% pfd.	50	4,400,000	6,400,000 4% S. Oct. 1, '97.	103	104	Twin City Rapid Transit.....com.	100	17,000,000	15,010,000	20	24
Boston Elevated R. R.....	100	10,000,000	.....	55	53	Twin City Rapid Transit.....7% pfd.	....	3,000,000	1,714,200 1 1/2% S. Jan., '98.	--	100
Brooklyn N. Y.—Mar. 14:						Montreal, Canada.—Mar. 14:					
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,401 2% Feb. 1, 1898.	191	--	Montreal Street Ry. Co.....	50	4,000,000	4,000,000 8% S. M. & N.	214	155
Brooklyn Rap. Transit Co., tr. certf.	100	20,000,000	20,000,000	377 1/2	88	Toronto Street Ry. Co.....	100	6,000,000	6,000,000 1 1/2% S. J. & J.	97 1/2	98 1/2
Brooklyn Heights Railroad.....	....	200,000	200,000	--	--	Memphis, Tenn.—Mar. 14:					
Brooklyn City RR.....guar.	100	12,000,000	12,000,000 2 1/2% Q. Jan., '98.	199	202	Memphis Street Railway Co.....	100	500,000	500,000	15	--
Brooklyn Queens Co. & Sub. RR.....	100	2,000,000	2,000,000	--	--	New Haven, Conn.—Mar. 14:					
Coney Island & Brooklyn RR.....	100	1,000,000	2,000,000 1 1/2% Oct. 1, '97.	150	180	Fair Haven & Westville RR.....	25	1,500,000	900,000 1% S. Sept. '97.	57	60
Kings County Elevated.....	100	4,750,000	4,750,000	48	52	New Haven Street Railway Co.....	100	1,250,000	1,000,000 3 1/2% A. July '96.	60	80
Kings County Traction Co.....	100	4,500,000	4,500,000 1 1/2% July 26, '97.	40	--	New Haven & Centerville.....	100	700,000	800,000	--	--
Nassau Electric Railroad.....	50	2,000,000	2,000,000	74	80	Winchester Avenue RR.....	25	1,000,000	600,000	40	42
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	--	--	New Orleans, La.—Mar. 14:					
Brooklyn B. & W. E. Railroad.....	....	1,000,000	1,000,000	--	--	Canal & Claiborne RR. Co.....	40	240,000	240,000 4% S. Jan., '98.	140	158
Buffalo, N. Y.—Mar. 14:						New Orleans & Carrollton RR.....	100	1,200,000	1,200,000 1 1/2% Q. Jan., '98.	122 1/2	124
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	62	65	New Orleans Traction Co.....com.	100	5,000,000	5,000,000 1 1/2% Q. Feb., '98.	2 1/2	5
Buffalo Railway Co.....	100	6,000,000	5,370,500 1% Q. Dec., '97.	81	84	New Orleans Traction Co.....pfd.	100	2,500,000	2,500,000	9	15
Columbus O.—Mar. 14:						Crescent City RR.....guar.	100	2,000,000	2,000,000 3% S. Jan., '98.	--	62
Columbus Street Railroad.....	100	8,000,000	8,000,000 1% Q. Feb., '98.	46	48	New Or. City & Lake RR.....guar.	100	2,000,000	2,000,000 4% S. Jan., '98.	82	--
Columbus Central Street Railroad...	100	1,500,000	1,500,000	--	--	Orleans Railroad.....	50	500,000	185,000 1 1/2% S. June, '94.	16	21
Charleston, S. C.—Mar. 14:						St. Charles Street Railway.....	50	1,000,000	1,000,000 1 1/2% S. Jan., '98.	54 1/2	56 1/2
Charleston City Ry. Co.....	50	100,000	100,000 8% S. Jan., '97.	--	--	New York—Mar. 14:					
Enterprise City RR. Co.....	25	1,000,000	250,000	--	--	Central Cross-town RR.....	100	600,000	600,000 2 1/2% Q. July, '97.	230	--
Chicago, Ill.—Mar. 14:						Christopher & 10th St. RR.....guar.	100	650,000	650,000 2% Q. Jan., '98.	155	165
Chicago City Ry. Co.....	100	12,000,000	12,000,000 8% Q. Dec. 31, '97.	--	235	Dry Dock, E. Bldg. & Battery RR...	100	1,200,000	1,200,000 1 1/2% Q. Feb., '98.	2 1/2	--
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800	11 1/2	12	Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000 1 1/4% Q. Jan., '98.	138 1/2	139
Lake Street Elevated RR.....	100	10,000,000	10,000,000	--	--	Bleecker St. & Fulton Ry. Ry. guar.	100	900,000	900,000 1/2% A. July, '97.	38	85
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	--	--	Broadway & Seventh Ave.....guar.	100	2,100,000	2,100,000 2 1/2% Q. Oct., '97.	215	--
Met. West Side El. const. stk.....	100	15,000,000	2,500,000	--	--	Can. Park N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 1 1/4% Q. Jan., '98.	170	180
North Chicago Street RR.....	100	10,000,000	6,600,000 8% Q. Jan., '98.	--	217	Eight Avenue RR.....	100	1,000,000	1,000,000	320	335
North Chicago City RR.....	100	10,000,000	2,499,900	--	--	42d St. & Grand St. Ferry RR. guar.	100	750,000	718,000 4 1/2% Q. Feb., '98.	330	350
South Chicago City Railway.....	100	500,000	500,000	--	--	Ninth Avenue RR.....	100	800,000	800,000	180	--
West Chicago St. RR. Co.....	100	2,000,000	1,603,200	--	--	Sixth Avenue RR.....	100	2,000,000	2,000,000	195	210
Chicago West Div. Ry.....guar.	100	20,000,000	18,189,000 1 1/2% Q. Feb., '98.	92	92 1/2	Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4% Q. Feb., '98.	800	825
Chicago Passenger Ry.....guar.	100	1,250,000	624,900 3 1/2% S.	--	--	Second Avenue RR.....	100	2,500,000	1,862,000 2% Q. Jan., '98.	165	--
Cincinnati, Ohio.—Mar. 14:						Third Avenue RR.....	100	12,000,000	10,000,000 2% Q. Feb., '98.	175	180
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000	--	20	42d St. Manhattan & St. Nich. Av.	100	2,500,000	2,500,000	64 1/2	67
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000 2 1/2% S. Feb., '98.	--	25	*Union (Huck)berry Ry.	100	2,000,000	2,000,000	190	210
Cincinnati Newport & Cov. St. Ry.	100	4,000,000	8,500,000	23	75	Newark N. J.—Mar. 14:					
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000 1 1/2% Q. Jan., '98.	115 1/2	116	Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000	46	50
Mt. Adams & Eden Park Inc. Ry....	50	2,500,000	2,200,000 1 1/2% Q. Jan., '98.	--	--	Newark Passenger Ry.....	100	6,000,000	6,000,000	--	--
Cleveland, Ohio.—Mar. 14:						Rapid Transit Street Ry.....	100	504,000	504,000 1 1/4% A.	185	193
Akron, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000 3/4% Jan., '98.	41	43	Pittsburg, Pa.—Mar. 14:					
Cleveland City Ry.....	100	8,000,000	7,600,000 3/4% S. Oct., '97.	59	60	Allegheny Traction Co.....	50	500,000	500,000	--	45
Cleveland Electric Ry.....	100	12,000,000	12,000,000 3/4% Q. Oct., '97.	60 1/2	61	Consolidated Traction Co.....com.	50	15,000,000	15,000,000 2% Jan., '95.	--	14
Detroit, Mich.—Mar. 14:						Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000 3% May, '97.	47	47 1/2
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	100 1/2	--	Citizens' Traction Co.....	50	1,500,000	900,000	61 1/2	--
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000 5% July, '96.	175	--	Duquesne Traction Co.....	50	8,000,000	13,000,000 6% A.	--	--
Rapid Railway Co.....	100	250,000	250,000	--	100	Pittsburg Traction Co.....	50	8,000,000	13,000,000 6% A.	--	--
Detroit Electric Railway.....	100	1,000,000	1,000,000	100	110	Federal St. & Pleasant Valley Ry...	25	1,400,000	1,400,000 2 1/2% Jan., '98.	--	--
Wyandotte & Detroit River Ry.....	100	250,000	200,000	--	--	Pgh., Allegheny & Man. Trac. Co....	50	8,000,000	12,991,839 2% Aug., '95.	--	--
Dayton O.—Mar. 14:						Pittsburg & Birmingham Trac. Ry...	25	8,000,000	3,000,000 1 1/2% Jan., '96.	19 1/2	19 1/2
City Railway Co.....com.	100	1,500,000	1,470,600 1 1/2% Q. Jan. 1, '98.	100	102	Pittsburg & West End Ry.....	50	1,500,000	1,500,000 5% A., June 30, '97.	--	--
City Railway Co.....pfd.	100	600,000	600,000 1 1/2% Q. Jan. 1, '98.	140	145	Second Avenue Traction Co.....com.	50	4,000,000	14,000,000	--	--
People's Street Railway.....	100	1,100,000	.....	100	--	Suburban Rapid Transit Co.....	50	800,000	200,000	--	--

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Consolidation of Baltimore Traction Company, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$230,100 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k \$5 per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$230,100 of stock owned by West Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Cross-town Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavana Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 8% on \$1,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 7% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.						Authorz'd	Issued.			
New Bedford Mass.—Mar. 14:							Boston, Mass.—Mar. 14:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '97.	...	158	American Bell Telephone Co.....	100	50,000,000	25,650,000	4% Q., Oct., '97	240	241
Northampton, Mass.—Mar. 14:							Erle Telegraph & Telephone Co.....	100	.....	10,804,600	1% Q., Aug., '97.	67	67%
Northampton Street Ry.....	100	800,000	225,000	5% A., July, '97.	165	175	New England Telephone Co.....	...	10,894,800	.....	\$1.25 sh., Q.	125	...
Omaha, Neb.—Mar. 7:							New York.—Mar. 14:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1% Q.	...	90
Paterson, N. J.—Mar. 14:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1% Q.	104	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	35	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	185	190
Providence, R. I.—Mar. 14:							Franklin Tel. Co.....	100	1,000,000	.....	2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	.....	58	61	Erle Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q., Aug., '97.	71	71%
Philadelphia.—Mar. 14:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	.....	1% Q.	107	110
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000	2,000,000	.....	14%	...	*International Ocean Tel. Co. guar 6%	100	8,000,000	.....	1% Q.	108	...
Hestonville, Man. & Fairmount....	50	1,966,100	1,966,100	2% Q., July 15, '97.	44	45	Mexican Telephone Co.....	100	2,000,000	.....	1% Q.	80	70
Hest'nvl'e, Man. & Fairm't. 6% pfd.	50	533,900	533,900	2% S.—July 15, '97.	61	65	*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1% Q., July, '97.	150	151
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '97.	63	66	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	.....	2% S.	71	76
Union Traction Co.....	50	30,000,000	5,986,095	.....	14%	15	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	90	95
aElectric Traction Co.....	50	.....	8,297,920	.....	71%	71%	*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2% Q.	111	113
dCitizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	300	...	Commercial Union Telegraph Co....	25	500,000	.....	5% S., July 1, '97.	86	86%
eFrankford & Southwark Pas. R.	50	.....	11,875,000	\$14 share A.—Apr. 97	380	...	Western Union Telegraph Co.....	...	97,870,000	.....	1% Q., Oct., '97.	86	86%
fLehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	47	...	Miscellaneous.—Mar. 14:						
gLombard & South Street Ry....	25	.....	1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000	.....	.....	14	...
hSecond & Third Streets Ry....	50	1,060,000	771,076	\$9 share A., Mar. 97	265	...	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	174 1/2	175
iPeople's Traction Co.....	50	10,000,000	600,000	3% A., April, '97.	89	...	Chesapeake & Potomac Tel. Co....	100	.....	.....	.....	50	57
jGermanatown Passenger Ry....	50	1,500,000	572,800	\$5.25 share—1897.	135	...	Chicago Telephone Co.....	100	.....	.....	.....	202	...
kGreen & Coates Passenger Ry....	50	500,000	150,000	3% July, 1897.	132	...	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	750,000	750,000	.....	64	78
lPeople's Passenger Ry.....com.	25	1,500,000	740,000	.....	...	...	Empire & Bay States Telegraph Co..	100	2,000,000	2,000,000	1% Q.	74	80
mPeople's Passenger Ry.....pfd.	25	750,000	277,402	.....	...	...	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	112	117
nPhiladelphia Traction Co.....	50	30,000,000	20,000,000	4% S.—Apr. 1, '97.	81	82	*Northwestern Telegraph Co. guar	50	2,500,000	2,500,000	2% Q.	87	...
oCatherine & Bainbridge St.....	50	.....	400,000	6% A.—Mar., '97.	135	145	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	120	122
pContinental Pass. Ry. Co. guar.	50	1,000,000	580,000	\$6 share—July, '97.	185	...	Southwestern New Eng. Teleph. Co..	100	8,000,000	.....	.....	...	...
qEmpire Passenger Ry. Co.....	50	600,000	600,000	.....	...	...				
rPhiladelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180							
sPhiladelphia & Gray's Fy. RR....	50	1,000,000	238,650	\$3.50 share July '97	86	...							
tRidge Avenue Passenger Ry....	50	750,000	420,000	\$12 share July '97	264	...							
uPhiladelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	...	...					
v17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	250,000	1% S., July, '97.	157 1/2	...							
wThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000	\$11 sh. A., July, '97	270	...							
xUnion Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 shre, July '97	227	228							
yWest Philadelphia Pass. Ry.....	50	750,000	750,000	\$10 share, July '97	225	235							
Rochester, N. Y.—Mar. 14:													
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18							
Reading, Pa.—Mar. 14:													
Reading Traction Co.....	50	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	...							
kCity Passenger Ry.....	50	850,000	350,000	July, '97.	111	...							
lEast Reading Electric Ry.....	50	1,000,000	1,000,000	July, '97.	64	...							
St. Louis Mo.—Mar. 14:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1888.	...	...					
Lindell Ry.....	100	2,500,000	2,400,000	1% July, '97.	124	126							
National Railway Co.....	...	2,500,000	2,479,000	1% July, '97.	...	...					
Case Avenue & Fair Grounds....	...	2,500,000	2,500,000	.....	...	...				
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '93.	90	110							
St. Louis RR.....	100	2,000,000	2,000,000	2% July, '97.	95	105							
Missouri RR.....	50	2,400,000	2,300,000	1% July, '97.	170	172 1/2							
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	...	...					
Southern Electric Ry.....	50	500,000	500,000	.....	50	52 1/2							
Southern Electric Ry..... 6% pfd.	100	1,000,000	1,000,000	3% S., Jan., '96.	100	102 1/2							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	52	55							
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '95.	...	175							
San Francisco, Cal.—Mar.													
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	107 1/2	109							
Geary Street Park & Ocean RR....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	53 1/4	...							
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	...	10							
Scranton, Pa.—Mar. 14:													
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12							
mScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	...							
nScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11							
Springfield Ill.—Mar. 14:													
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11							
Springfield O.—Mar. 14:													
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2							
Springfield, Mass.—Mar. 14:													
Springfield Street Ry.....	100	1,200,000	1,000,000	8% A.	205	210							
Toronto Canada.—Mar. 14:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1% S.	97 3/4	98 1/4							
Montreal Street Railway Co.....	...	4,000,000	4,000,000	4% S.	254	255							
Washington, D. C.—Mar. 14:													
Belt Ry. Co.....	50	500,000	500,000	.....	...	...				
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	75 1/2	75 3/4							
Columbia Ry. Co.....	50	400,000	400,000	5% A.	70	75							
Eckington & Soldiers' Home Ry....	50	707,000	652,000	.....	...	...				
Georgetown & Tenallytown Ry....	50	200,000	200,000	.....	...	...				
Metropolitan RR. Co.....	50	1,000,000	437,180	2% Q.	120	121							
Worcester, Mass.—Mar. 14:													
*Worcester Traction Co.....com.	100	8,000,000	8,000,000	.....	17	18							
*Worcester Traction Co.....6% pfd.	100	2,000,000	2,000,000	3% S., Sept., '97.	8	97							
Worcester & Suburban Street Ry..	100	550,000	542,500	4%, 1896.	85	...							
Wilkesbarre, Pa.—Mar. 14:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
d Practically all shares owned by Union Traction Company.
e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
f Lease to Electric Traction Company.
g Controlled by Frankford & Southwark Passenger Railway.
h Leased to People's Passenger Railway at \$5 per share.
i Majority of stock owned by People's Traction Company.
j Leased to Union Traction Company.
k Lease transferred to Union Traction Company.
l Leased to Union Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900, and \$30,000 per annum thereafter payable semi-annually, rental declared as a dividend semi-annually.
m Dividend of 10% guaranteed by Reading Traction Company.
n Dividend of 6% guaranteed by Reading Traction Company.
o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Mar. 14:												
Fort Wayne Electric Co.....	..	.....	.....	.....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.....	25	.....	.....	.....	.....	.....	
General Electric Co.....com.	100	40,000,000	30,460,000	2 3/4 % Q., Aug., 1898.	30 1/2	30 1/2						
General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	21 1/2	21 1/2						
T.-H. Elec. Co. T. Secur., Series D.....	..	.....	.....	.....	8 1/2	8 1/2						
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	..	..			
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 3/4 % Q., Feb., '98.	51	53						
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	..	..			
New York.—Mar. 14:												
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	183	183 1/2						
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2 % Q., Oct., '97.	104	105						
Edison Ore Milling Co.....	100	.....	.....	.....	..	..	
Edison Electric Storage Co.....	100	.....	.....	.....	..	..	
General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	80 1/2	80 1/2						
General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	90	90						
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	.....	41	..						
United Elec. Lt. & Pow. Co.....pfd	..	.....	.....	.....	..	..
Pittsburg, Pa.—Mar. 14:												
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	..						
East End Electric Light Co.....	50	800,000	800,000	Q	..	10						
Philadelphia, Pa.—Mar. 14:												
Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	..						
*Electric Storage Battery Co.com.	100	8,500,000	.....	.....	20 1/2	21 1/2						
*Electric Storage Battery Co...pfd.	100	5,000,000	.....	.....	22	23						
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	21 1/2	22						
*Penna. Ht., Lt. & Pow. Co...pfd.	50	5,000,000	.....	6 % Oct., '97.	56	59						
Pennaria Elec. Light & Power Co...	10	6,500,000	550,000	\$32500 dis. Jan.11'97	13 1/2	14						
Southern Elec. Light & Power Co...	10	187,500	187,500	....	10	..						
Miscellaneous.—Mar. 14:												
Brush Electric Co.....	50	.....	.....	.....	..	..	
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	.....	82 1/2	85						
Edison Illg. Co. (St. Louis).....	..	.....	.....	.....	..	..
Eddy Electric Mfg. Co.....	25	.....	.....	.....	..	..	
Hartford (Conn.) Elec. Light Co....	100	.....	.....	.....	15	15						
Hartford (Conn.) Lt. & Power Co....	100	850,000	.....	.....	118	125						
New Haven (Conn.) Elec. Lt. Co....	25	175,000	.....	.....	4	10						
Narragansett (Prov., R.I.) Elec. Co..	100	100,000	.....	.....	148	..						
Rhode Island Elec. Protec. Co.....	50	1,200,000	.....	2 % Q., Oct., '96.	82 1/2	85						
Royal Elec. Co. (Montreal).....	100	.....	.....	.....	114	118						
Toronto (Canada) Elec. Light Co....	100	1,000,000	.....	2 % Q	145	150						
Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	1 3/4 % Q	153 3/4	155 1/4						
Woonsocket (R. I.) Electric Co.....	100	.....	.....	3 % S, Dec. 1, '96.	90	100						

Digitized by Google

PASSENGER RAILWAY.

NOTES FOR INVESTORS.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Mar. 14, 1898						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co. 1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	106½	107½
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
St. Louis & E. St. L. Electric 1st mtg. 6s.	1,000,000	800,000	1904	J. & J.	100	102
St. Louis RR. Co. 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis & Sub. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. Income 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry. 1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	112½	113½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Mar. 1898						
California St. Cable RR. 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	119
Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	117
Geary St. Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	102	103
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	128	129½
Metropolitan Ry. Co. 1st mtg. 6s.	200,000	200,000	1918	J. & J.	128	129½
Omnibus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	124
Park & Cliff House RR. 1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	109½
Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	111
Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
Sutter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Mar. 11, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	121
Eckington & Soldiers' Home Ry. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Mar. 14, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind. polis) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95½	98
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102	102½
Crosstown St. Ry. (Columb., O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & J.	95	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	93	97
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	93	97
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	113	113½
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	92	94
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	102	104
No. Hudson Co. Ry. (N. J.) Deb. g. 6s.	500,000	439,000	1902	F. & A.	118	119
Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108½	109½
Rochester (N. Y.) Ry. 1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	99
St. Paul City Ry. Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Mar. 14, 1898.						
Edison Elec. Illuminating Co., Boston.....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	101½	.....
Pittsburg, Pa.						
Date of Quotation—Mar. 11, 1898						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 4s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Mar. 14, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,812,000	1910	.....	111½	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,176,000	1993	.....	116	.....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Mar. 14, 1898						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telephone Co. 1st mtg. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 1st mtg. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Mar. 14, 1898.						
American Electric Heating.....6s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 6s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 1st mtg. 6s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 1st mtg. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 1st mtg. 6s.	71,000	.....	.....	.....	.....	.....
†Unlisted						
†Nominal.						

Late quotations for copper are: Electrolytic, 11½c.; Lake, 11½@12c.; cast, 11.65c.

The Citizens' Passenger Railway Company of Philadelphia has declared a dividend of \$3.25 a share.

The Citizens' Electric Light & Power Company of St. Louis has increased its capital stock from \$750,000 to \$2,000,000.

The stockholders of the Allegheny County Light Company, Pittsburg, Pa., have voted to increase the capital stock from \$1,500,000 to \$2,500,000.

The directors of the Ridge Avenue Passenger Railway Company, Philadelphia, have declared a dividend of \$3 per share on the stock.

The Edison Electric Illuminating Company of Brooklyn reports for February: Gross, \$75,601; increase, \$5,783; net, \$38,625; increase, \$4,622.

The Western Union Telegraph Company has declared the regular quarterly dividend of 1½ per cent., payable April 15. Transfer books close March 18 and reopen April 1.

The United Traction & Electric Company of New Jersey has declared a dividend of 1 of 1 per cent. on its capital stock, payable April 1. Books close March 21 and reopen April 3.

The Holbert bill in the New York Legislature, authorizing cities of the third class to make five year contracts for lighting the streets, was called up in the Assembly and amended so as to apply only to cities of 4,000 or less.

The New York State Railroad Commission has granted the application of the Van Brunt Street and Erie Basin Railroad Company of Brooklyn to change its motive power from horses to the overhead electrical trolley system.

The Government has placed an order with the Electric Storage Battery Company, Philadelphia, for a number of storage batteries to be used for lighting fortifications along the coast. Negotiations are also pending for batteries for submarine boats.

A meeting of the minority stockholders of the Wilmington City Electric Railway Company was held at Wilmington, Del., on the 11th inst., when the proposition to sell their stock to the Clark syndicate at \$13 a share, payable in 5 per cent. gold bonds, was accepted. Most of the stock has already been deposited.

A bill now before the New York Legislature provides that the Railroad Commissioners shall within six months designate a suitable fender for trolley and cable cars, and that by January 1, 1899, such fenders shall be applied to all cable and electric cars used in cities of 60,000 inhabitants or more.

The Kings County Electric Company, whose plant is being erected in Gold street, Brooklyn, N. Y., is said to have already secured contracts to furnish almost its entire voltage of more than 20,000 horse-power. The directors of the company, it is asserted, are considering the advisability of buying more ground and extending the plant at an early day.

For the purpose of forcing the State Legislature of Michigan to consider the question of the local taxation of property of railroad, telephone and telegraph companies in accordance with the bill already prepared, Governor Pingree has issued a call convening the Legislature in special session Tuesday, March 22.

The Stock List Committee of the New York Stock Exchange has been empowered to add to the list from time to time the \$1,262,000 new stock of the Edison Electric Illuminating Company of New York as notice shall be received that the same has been issued, making the total amount listed \$9,200,000.

An anti trust bill introduced in the Ohio Legislature fines corporations and firms from \$50 to \$5,000 and imprisonment from six months to one year for restricting commerce, reducing production, preventing competition or fixing price of commodity or transportation. Forfeiture of franchise is also provided.

The purchase of the gas and electric light companies at Herkimer, Ilion and Little Falls by a syndicate of New York capitalists is to be followed by a consolidation of the three companies into one corporation. The capital of the consolidated company will be \$400,000 and the name The Central New York Light & Power Company.

The decision of the Supreme Court of the United States in the Nebraska maximum freight case establishes the doctrine that the courts will not permit the Legislature of a State to regulate the railroad rates to such an extent as to deprive railroad companies of reasonable compensation for their services based upon the fair value of the property which they use for the benefit of the public.

The Appellate Division of the Supreme Court has denied a motion on behalf of the New York Rapid Transit Commissioners for a reargument of the rapid transit question upon the point as to the bond to be required, but the Court in effect sustained the contention of the Rapid Transit Commissioners that the greater part of the security demanded should be conditioned only upon the construction of the road and should not cover equipment and payment of rentals. It is provided in the opinion that the \$15,000,000 bond shall be divided, \$14,000,000 to apply to construction only and \$1,000,000 to be a continuing guarantee applying to equipment and operation.

At the annual meeting of the Consolidated Traction Company of New Jersey, on March 28, the stockholders will vote on a proposal to lease the property of the company to a new corporation, known as the North Jersey Traction Company, that will be organized. The new company will take in not only the Consolidated Traction Company, but also one or perhaps two independent lines now operating in Orange and perhaps also the Paterson Street Railway. The amount of capital stock has not yet been fixed nor have the terms for issuing it been finally determined. The North Jersey Traction Company will guarantee annual dividends on the Consolidated Traction Company stock, beginning with 2 per cent., and increasing gradually until at the end of eight years the rate will be 4 per cent., which will be the amount paid for the balance of the lease. The plan will undoubtedly go through, as the projectors own more than a majority of the Consolidated stock, and will have a controlling interest in the North Jersey Traction Company.

The Appellate Division of the Supreme Court sustained the action of the lower court in granting to Patrick H. Flynn an injunction restraining the Coney Island & Brooklyn Railroad Company from making a mortgage, the total authorized amount of which, for present and future use, would, it is alleged, be in excess of two-thirds the present value of the road. The proposed amount of the mortgage was \$1,500,000, but of this sum \$500,000 was not to be issued at present, being reserved for future requirements; but the Court holds that under the law the total authorized issue of bonds, as well as the actual issue, must not exceed the company's capital stock nor two-thirds the present value of the property.

The Union Light & Power Company of Salt Lake City, Utah, has filed in the office of the county recorder a mortgage for \$750,000 in favor of the Central Trust Company of New York, to secure an issue of 750 bonds of the denomination of \$1,000 each. Under the terms of the mortgage, the company conveys to the trustee all of the property and franchises of the Salt Lake and Ogden Gas & Electric Light Company, the Big Cottonwood Company, and Citizens' Little Cottonwood and Pioneer companies, subject to certain indebtedness specified in detail. The bonds secured by this trust deed bear 5 per cent. interest payable semi-annually and are redeemable at 105 on any interest day after November 1, 1907, both interest and principal payable in gold coin of the present weight and fineness of United States coin. Default in interest for six months is stipulated as cause for foreclosure under the trust.

ELECTRICITY.

Vol. XIV.

NEW YORK, MARCH 23, 1898.

No. 11.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	161-162
Electricity on Shipboard.	
Another Vacuum Tube Light.	
Long Distance Submarine Telephoning.	
The Paris Exposition of 1900.	
Under the Searchlight,	162
The Northwestern Electrical Association,	163
American Institute of Electrical Engineers,	163
A Portable Electric Railway,	163
A Year's Work in the U. S. Patent Office,	164
A Successful Kentucky Girl (Portrait),	164
Electrically Operated Movable Platforms for the Universal Exposition at Paris. By G. Hamelin. (Translated),	165
Purification of the Electrolyte in Copper Refining,	165
On the Manufacture of Lamps and Other Apparatus for 300-Volt Circuits. By G. Binswanger Byng. (Concluded),	166
Electrical Exhibition Notes,	168
Two Hundred Mile Electric Railway,	169
The Joint International Meeting at Laredo, Tex.,	169
Good Books for Electrical Students,	169
Legal Notes,	169
Canadian Notes,	169
Proposals Invited,	169
The News,	170
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous,	
Recent Company Elections,	171
Commercial Paragraphs,	171
Incorporations,	171
Electrical Patent Record,	172
Telephone and Telegraph,	172
Electrical Securities—Stocks, Bonds, Etc.,	173
Notes for Investors,	176

EDITORIAL NOTES.

Electricity on Shipboard.

Strange as it may seem, electricity has but comparatively recently been adopted to any great extent on shipboard. This has probably been due to the fact that the various manufacturers of electrical apparatus were devoting their energies to perfecting electrical machinery for shore use, and gave little attention to bringing out special designs suitable for the use of ships, where space is limited and unusual conditions exist.

Electricity was however made use of for illuminating purposes on vessels at a comparatively early date, probably the first installation of this nature being that on the steamer Columbia of the Oregon Railway & Navigation Company, some eighteen years ago. These early plants were necessarily more or less crude, the armatures of the dynamos being driven by belts from engine pulleys. As will readily be seen, this method was by no means economical of space and was therefore adopted but slowly. The direct coupled generating plant was the solution of this problem owing to its compactness, and has now been generally adopted by almost all classes of vessels. When the electric current first came into use on shipboard it was feared that a ship's compass would be affected through magnetic leakage from the dynamos, but this danger has been averted by using only generators with closed magnetic fields and arranging the conductors concentrically in the neighborhood of a compass.

At the present day the electric current is slowly but surely superseding compressed air and steam as a motive power for various purposes, especially on vessels of the United States Navy. Electric power is generated on men-of-war not only for lighting purposes but for controlling searchlights, operating small ventilating fans and for signaling at night. Of the latter there are several systems, but probably the most successful consists in suspending in a vertical line from the rigging four double lanterns spaced at short intervals apart, each containing two 50 candle-power incandescent lamps. Each of the double lanterns is fitted with two lenses, the upper one showing red, the lower white. These eight lamps in the four lanterns of two colors each allow of thirty different combinations being made, each combination corresponding to a given letter of the alphabet or sign. The electric lamps are separately connected, all the conductors leading to a common keyboard conveniently located. By properly manipulating the keys any lamp or combination of lamps may be simultaneously lighted or extinguished.

This is however but one of the uses to which electricity is applied. What is known as the running or side lights of a vessel are now also lit by means of the electric current. With a view to reducing to a

minimum the chance of a running light's becoming extinguished (a very serious matter), each lantern contains two incandescent lamps separately connected. In the event of a break occurring in one of the circuits a specially devised indicator records the fact.

Another ingenious use to which electricity has been put in men-of-war is a device arranged to sound an alarm when the temperature at the point where the device is located reaches a certain number of degrees. This arrangement, which is simplicity itself, consists of a small glass tube having a wire in each end, and partially filled with mercury. The device is placed in a vertical position in circuit with a battery and bell, the latter ringing when the mercury by expanding comes in contact with the upper wire, thereby closing the circuit.

Heat alarms of the above description have been used quite extensively in vessels of the United States Navy as a precautionary measure against fire due to spontaneous combustion in coal bunkers. On a large number of fighting ships electric motors are used to operate the valve of the steam steering engine, and in the case of a German man-of-war recently constructed, the steam steering apparatus has been done away with entirely, an electric motor having been substituted. Again, for fog signaling, the whistle is in many instances blown automatically at regular intervals by means of a motor operated by electricity. In quite a large number of vessels electric power has superseded compressed air in the operation of ammunition hoists, and in one or two recent cases the lighter gun turrets have been operated by electric motors. As an instance, two of the turrets on the cruiser Brooklyn are now revolved in this manner—the electric current having proven extremely well adapted for such usage—and are stated to have given entire satisfaction. In some of the vessels which are being constructed a further extension of electric transmission of power is now being made to include the large turrets and all the gun-mount movements of the large guns.

By no means the most unimportant use however to which electricity is put at the present time on most of our men-of-war is in operating what is known as the Fiske range-finder. This ingenious device, which has frequently been described, enables the distance of an enemy's ship to be exactly determined by means of two telescopes electrically connected, through a well-known trigonometrical principle. Knowing the length of the base line and ascertaining the number of degrees in the two angles at the base of the triangle, the length of one of the other sides is automatically registered on a dial.

There would seem to be among marine engineers a fear that electrolytic action might be set up between the hull of a steel vessel and the salt water. It has been claimed that vessels equipped with electrical plants have developed rapid deterioration in

all sea-water pipe connections. Whether this has been due to electrolytic action or some other cause has not yet been fully determined, little reliable data on this subject having up to the present been collected. It would seem however very questionable whether any great deterioration could take place through this cause, owing to the hull of a modern steel vessel offering so slight a resistance to the passage of any stray currents and to the fact that a large body of salt water is a comparatively good conductor.

* * *

Another Vacuum Tube Light.

In an editorial which appeared in *ELECTRICITY* a short time ago we described at some length a method of vacuum tube lighting invented by Mr. D. Macfarlane Moore of Newark, N. J. We now hear of another invention in this line which it is claimed will revolutionize our present method of lighting. If we are to believe one of the sensational dailies, Mr. John H. J. Haines, the originator of this new system, has succeeded in obtaining a light differing little from that which the firefly emits. In other words, he has apparently discovered what such men as Edison, Tesla, Crookes and other scientists have been seeking for years—light without heat.

Mr. Haines has been experimenting on this new light since 1890. The basic principle on which he has worked is the vacuum tube, but his results were obtained, so it is said, along lines differing radically from those followed by other experimenters. His chief aim has apparently been, not only to procure a cold light, resembling daylight in its whiteness, but to procure a vacuum tube light that would be economical in operation.

The system Mr. Haines has devised is somewhat novel. His vacuum tubes contain a highly rarefied gas. The efficient production of light from the tubes depends upon the great frequency of well-blended electrical oscillations. The system is said to be extremely simple, no elaborate generators being required. His apparatus may be attached to an ordinary alternating current electric lighting circuit. By means of two step-up transformers the voltage of the ordinary commercial circuit is greatly increased until in the neighborhood of 1,000,000 volts are obtained. The vacuum tubes are some five feet in length and two and a half inches in diameter, presumably of the ordinary type, capped with tinfoil electrodes. The light given forth is extremely white and diffuses itself evenly throughout a room, enabling a photograph to be taken, so Mr. Haines claims, in the short space of fifteen seconds.

With the large number of new illuminants that have recently made their appearance some ought certainly to prove a success. No sooner does an alleged new illuminant make its appearance, however, than a company is formed to exploit it, and that very frequently is the last heard of it. In the case of the Haines vacuum tube light, as usual, a company is said to be organizing with a capital of \$10,000,000 for the development of the invention.

* * *

Long Distance Submarine Telephoning.

There is said to be a scheme on foot among a number of capitalists and several cable and telephone companies toward establishing a transatlantic telephone cable line. If such is the case the matter is being kept exceedingly quiet, no information of any kind being allowed to leak out. It might, however, be interesting to learn how the promoters of this enterprise propose to overcome seemingly insurmountable difficulties—and justly looked upon as such, all previous attempts in this line having proven dismal failures.

The problem of overcoming static induction has so far been the main stumbling-block. Several methods or schemes have been from time to time suggested as a solution, but have invariably proven inadequate

when fairly tested. There is said to be a submarine telephone cable in commercial operation in South America, twenty-eight miles in length, which gives fairly good results, and there is also a successfully operated submarine telephone cable across the English Channel, twenty-two miles in length. When, however, it is a question of telephoning some 2,500 miles over a cable, which would be the minimum length of a transatlantic cable, at the present state of the art the difficulties would be insurmountable. Through static induction there is a loss, the quick, short sound waves which we ordinarily hear over the telephone would be changed into long, slow vibrations which the human ear would be unable to detect.

At the present time the only known method of overcoming static induction is in increasing the size of the copper conductor and the thickness of the insulating material. In order to overcome static induction in a cable 2,500 miles in length the copper conductor would probably have to be not less than five inches in diameter, which would make the cost of the copper alone something enormous, and would prohibit the undertaking at the very start. It moreover would be practically impossible to lay such a cable, but even assuming that it could be successfully laid, the price that would have to be charged for, say, "five minutes" conversation, would necessarily be so excessive in order to pay a fair interest on the investment that it would prohibit its being used. Prof. Alexander Graham Bell, as reported in the *New York Morning Telegraph*, refers to the matter as follows:

"That the problem has been one of the hardest electricians have ever had to cope with is admirably proven by the fact that so great an enthusiast on the subject of submarine cables as Lord Kelvin, who is, by the way, a very sanguine man, has heretofore considered it as insolvable."

* * *

The Paris Exposition of 1900.

The Paris Exposition of 1900 has for some time past been creating considerable interest. That France will endeavor in every way to make this event a greater success than our Chicago Exhibition is unquestionable, although it is frankly acknowledged that it would be an impossibility to equal the Columbian Exposition as far as beauty of location is concerned. It would probably be difficult to find a more beautiful or suitable spot for holding a universal Exposition than along the shore of Lake Michigan. In this respect Paris is undoubtedly seriously handicapped, it having been decided to hold the Exposition of 1900 on the public grounds extending on both sides of the Seine from the Place de la Concorde to a point beyond the Pont de Jena, comprising the Champs de Mars, the Trocadero Palace, the Esplanade des Invalides, the Quay de la Conference, the Cours de la Reine and a large portion of the Champs Elysées.

The system of admission for exhibitors is to be by double juries—in other words, every precaution is being taken to exclude articles that would be of little interest to the general public.

There will be no large foreign buildings similar to those at Chicago. The exhibits will be placed by subjects, every nation being expected to show its products in the building for all belonging to the same classification. By this arrangement a visitor will be able to examine in regular order the various exhibits of any nation.

There will be in all eighteen groups and 120 classifications. At Chicago there were but twelve groups while on the other hand there were almost one thousand sections. The exhibit of electricity and electrical apparatus will come under Group V, and is expected to play a very important part. Germany is said to be making immense preparations in this line with the hopes of excelling the world. This country will however be exceedingly well represented, and it

is therefore very questionable whether Germany's hopes are not doomed to disappointment.

It is as yet too soon to form any very exact idea of what the exhibits will be, but one of the most unique features already spoken of is an electric organ at the striking of whose notes a tiny ballet dancer will appear in the air dancing to the music, the whole forming a mimic ballet above the organ. Naturally, among other things, all the latest electrical inventions and apparatus will be on exhibition, it being the aim of the committee in charge to make the Exhibition a great success from an educational standpoint.

As a motive power electricity will reign supreme. During the Exposition of 1889 the electric current was freely used for illuminating purposes, the electric fountains especially attracting wide attention. Although electricity was used at that time to a considerable extent, gas was held in reserve, it being feared that an accident might happen to the generating plant. In 1900 it is proposed to make electricity the motive power of the whole Exhibition. M. Picard, the Commissioner General, who is also an able engineer, contemplates, it is said, generating sufficient current for all lighting and motive purposes at the coal mines of Nord and Pas de Calais, which are situated about 100 miles from the French metropolis, delivering the current by means of a high tension transmission circuit to the Exhibition grounds.

It is moreover M. Picard's intention that throughout the various buildings the electrical machinery shall be shown in action where such apparatus is used in the manufacture of a commercial product. Thus, for example, electric motors employed in operating printing presses would have their armatures revolved through the medium of an electric current generated at a point one hundred miles away.

There will be a large number of electric railways constructed, all leading to the grounds, with a view to affording visitors every facility for transportation. There will also undoubtedly be a moving platform operated by electricity, somewhat similar to the one at the Chicago World's Fair. In short, it is intended that electricity shall play the grand rôle at the Universal Exposition of 1900, and many new applications of the current may be looked for.

Under the Searchlight.

Notes and Comments on Various Topics.

Mr. F. P. Fish, general counsel of the General Electric Company, has sailed for Europe on a short business trip.—*News Bureau.*

Can it be possible that the president of the G. E. Company has decided to act upon our suggestion relative to creating a trust in warships, and has dispatched Mr. Fish to make investigations as a preliminary to drawing up the papers? It looks that way. We shall await the outcome of Mr. Fish's trip with considerable interest.

* * *

A CABLE dispatch to the *New York Sun* dated London, March 19, says: "The Marconi wireless telegraph boom seems to have petered out, and the syndicate which kept it going for over a year has arrived at the conclusion that there is no money in it. The fact is, the commercial aspect of this interesting subject led to a fuss long before the improved handling of the old discovery had got beyond the laboratory stage. Big brains are now working upon it, and in due course a practical method of utilizing the discovery will probably be forthcoming. Prof. Oliver Lodge, for instance, says he has an entirely new method of telegraphing without wires which will, he hopes, enable him to send messages long distances. He does not depend upon waves but upon magnetism, which is independent of obstacles; and he believes it will be applicable

to signaling between ships and between the shore and ships. Prof. Lodge's ideas are not for sale to any syndicate."

* * *

SOME extraordinary displays through the agency of electricity may be expected for the Charter Day celebration next May in New York. The committee on decorations has secured, so it is said, for the celebration all the manhole subways in Broadway and Fifth Avenue and in them it is proposed to locate powerful electric searchlights. The holes will be covered with a grid which will cause the rays to shoot upward in elongated lines forming the American flag with the stars uppermost. From the Battery to Central Park will be stretched miles of wire, hung thickly with colored globes, and an alternating current will be shot through them. At equal distances great varicolored globes will be suspended, and powerful lights will play upon them. The committee has adopted as a special Charter Day flag a shield bearing the city's coat-of-arms, circled by five stars, emblematic of the five boroughs. This is also susceptible of clever light effects and will be used in the night displays. It has not yet been definitely decided whether the Brooklyn Bridge will be electrically illuminated or not. In all probability it will be the center of an enormous pyrotechnical display, however.

* * *

THE New York *Journal of Commerce* in a recent issue refers to electrical apparatus manufactured in this country and exported abroad as follows:

London advices to an electrical company indicate that the prices being sent from here, both on electrical apparatus and machinery, compared with those on the other side, on railroad work, are from 6½ to 7½ per cent. cheaper, and they further state that if these prices are maintained, the probabilities are that a considerable amount of work will be ordered on this side. This applies particularly to motors and trolley equipments in general, not necessarily for European roads but for work in which European capital is interested in other parts of the world. The general opinion prevails that with the success American electrical equipment is meeting abroad, a good foreign business may be anticipated throughout the present year.

It is extremely difficult to see how manufacturers of electrical machinery in the United States can afford to sell their goods 6½ to 7½ per cent. cheaper than apparatus turned out on the other side otherwise than at a loss, especially when we recall the fact that the price of labor is about twice as high here as in Europe. It may be, however, that the European manufacturers have not as yet caught on to the trick of turning out stocks and bonds in conjunction with other products.

* * *

THE New York *Morning Telegraph* says:

A prominent investor "who trots in the same class with the well-known gentleman having authority to speak," and the "man high in official circles whose name cannot be used in this connection," so familiar in the rumor monger's vocabulary, came out yesterday with this little boom for General Electric: "During the recent decline the comparatively small number of shares of General Electric which have come on the market indicate how strongly the stock is held." Those who know how much the boom manufacturer of General Electric is overworked will appreciate this desperate attempt to give the stock a boost. The heartrending search by William J. Clark for a press agent for General Electric who could reel off fairy stories at will is still remembered in the Street.

Judging from the large number of attractive and enticing paragraphs that are constantly appearing in various papers on General Electric, Mr. Clark's efforts must have been crowned with success.

* * *

THE *Street Railway Review* gives the following account of a professional contortionist who is in the habit when short of funds of falling and dislocating his hip whenever in his opinion there is an opportunity of collecting damages from a railway company: "Some months ago a man fell on the platform of a passenger station near Indianapolis, having caught his heel in a crack, and the result was a dislocated hip. The company settled for \$2,200 and attorney's fees, and extended courtesies in the way of furnishing transportation for the man and his nurse,

etc. Quite recently a similar accident occurred in Virginia and a claim of damages was presented. The man had been seen the day before hunting about the platform for a hole in which to catch his heel, and a traveler who was present recognized him as the victim of the 'accident' in Indiana. The Virginia road did not settle his claim, and the Indianapolis company want his present address."

* * *

THE following from the San Francisco *Call* should be read by all advocates of municipal ownership:

"It is by no means creditable to the officials of the city that so simple a municipal work as that of street lighting should be a problem impossible of solution. It appears, however, that the task is too hard for the supervisors, and as a consequence we are to have lights shut off for a good many nights in each month from now to the end of the fiscal year.

"There are people who talk of municipal ownership of water works and lighting plants. They fondly believe the supervisors could take hold of the business of those works and operate them with success. To these people the failure of the supervisors to properly manage even so small a thing as street lighting when they have none of the bother of running the plant will doubtless appear as a direct evidence of diabolism. 'The devil is in it,' they will say when they go out some night and find the streets unlighted, and they will add, 'He delights in darkness and has put up this job.'

"The general mass of citizens, however, will not have to lug in the personality of Satan to explain the situation to their understanding. It is but another of the thousand evidences of administrative incompetence that is the bane of American municipalities. If the thing were not of such common occurrence and so similar to the results of equal incompetence in the management of all kinds of municipal work, there would be something almost startling in the fact that a city as rich as San Francisco, having all the appliances of modern science and art at command, cannot keep its streets lighted. As it is, the darkness will simply give occasion to a few more crimes than usual; life and property will be a little less safe; there will be some grumbling and some swearing at the supervisors, and then, with our habitual American toleration of official misconduct, we will let the thing pass and wait for the coming of the new fiscal year."

* * *

A VERDICT of \$9,000 in favor of the plaintiff in a damage suit brought against the Woonsocket Street Railway Company by a wheelman who came into collision with one of the company's cars has prompted the manager of the company to post up the following instructions to motormen on the line. The suggestion of sarcasm in the order will be appreciated by impatient persons who ride in the cars:

"When a motorman sees a bicyclist approaching the car and going in an opposite direction, the motorman shall, when thirty feet from said bicyclist, stop his car and not start it until the bicyclist has passed. If a bicyclist is going in the same direction and ahead of the car, the motorman must keep his car 100 feet in the rear of the bicyclist and not approach nearer."

* * *

SPEAKER REED recently wished to see a political friend on some very important business and telegraphed him to go at once to Washington. The friend took the first train, but a washout on the road soon stopped him. Going to a telegraph office he sent this message: "Washout on the line. Can't come," to which in due time he received the following reply from the Maine statesman: "Buy a new shirt and come any way."

Telephone Lines and Thunderstorms.

The German Postal authorities have recently been examining into the influence exercised by telephone lines on the frequency of thunder claps. Observations were made at 140 places with telephonic com-

munication, and at 560 places without. The results show that while under the latter circumstances an average of five detonations occur during a thunderstorm, yet where telephone lines are present this number is reduced to an average of three, the flash also appearing to be considerably lessened.

NORTHWESTERN ELECTRICAL ASSOCIATION.

The Committee Accepts the Invitation to Visit Duluth and Superior in June.

JANESVILLE, Wis., March 14, 1898.

At a meeting of the committee having in charge the summer meeting of the North-western Electric Light Convention—present Messrs. P. Norcross, chairman, P. H. Korst, Henry L. Doherty and J. M. Hill—the following resolution was put to vote and unanimously carried:

Resolved, That as a Committee of the Northwestern Electrical Association, we accept the invitation of the cities of Duluth and Superior to visit those cities next June.

That Mr. J. M. Hill of Chicago is authorized by this committee to make arrangements with any steamboat company for a summer meeting of said Association, to be held en route from Chicago via Sault Ste. Marie, Hancock and Houghton to Duluth.

American Institute of Electrical Engineers.

The 123d meeting of the Institute will be held at 12 West 31st street this (Wednesday) evening at 8 o'clock.

A paper will be presented by Prof. Reginald A. Fessenden, of Allegheny, Pa., on "Insulation and Conduction."

Applications have been received from the following candidates for associate membership, which will be acted upon by the council at its meeting April 27: N. S. Hopkins, Schenectady, N. Y.; Newton L. Schloss, New York City; Clarence R. Tolman, Silverton, Col.; Frederick A. Muschenheim, New York City; Felix L. Cadou, Washington, Ind.; George J. Henry, Jr., New York City; Robert Lindsay, Cleveland, O.; Ernest S. Vinten, New Haven, Conn.; Wyatt H. Allen, Garwood, N. J.; Wm. H. Fitzhugh, Bay City, Mich.

Members who desire to present papers during the season of 1898 are requested to communicate with Mr. Herbert Laws Webb, 15 Dey street, chairman of the Committee on Papers and Meetings, or with Mr. Ralph W. Pope, the secretary.

A Portable Electric Railway.

A description of a practical form of temporary light railway is described in the *Zeitschrift für Elektrotechnik* and accredited to "Mittheilungen über Gegenstände der Artillerie- und Geniewesen." The rails have the usual profile and are about 2½ inches in height, resembling those customarily employed for such work. Each portable section is made up of the two rails fixed on a number of sleepers, five for instance. Some of these sections are made with the addition of an inverted U-shaped iron yoke, to carry the trolley wire, the sections with these yokes being placed about 80 feet apart on straight stretches of track, and of course closer together on curves. Each of these adds a hundred weight to the weight of the section in question. The two feeders from the generating stations are carried either on poles sunk in the ground in the usual manner, or on specially designed standards. A simple car has been designed for the purpose of erecting the trolley wire. The drum carrying the wire is supported on trestles on this car, and is run off over a pulley on a level with the trolley-wire supports, this pulley being mounted in bearings at the top of a double ladder on the car. The car itself is fastened to the rails while the wire is being run off, to allow of the necessary strain being put on the wire before the car and ladder are removed.—*The Electrician, London.*

Help to Light the Electrical Trust by subscribing for **ELECTRICITY.**

A YEAR'S WORK IN THE U. S. PATENT OFFICE.

Rapid Advance in Electrical Industries.

The annual report of the Commissioner of Patents for the calendar year 1897 has been laid before Congress. It was prepared by Assistant Commissioner Greely, who was Acting Commissioner for several months preceding the death of the late Commissioner Butterworth.

In 1897 there were received 45,661 applications for patents, 2,150 applications for designs, 94 applications for reissues, 2,176 caveats, 1,946 applications for registration of trademarks, 66 applications for registration of labels and 26 applications for prints. There were 23,729 patents granted, including designs, 65 patents reissued, and 1,671 trademarks registered. The number of patents that expired was 12,926. In proportion to population more patents were issued to citizens of Connecticut than to those of any other State—1 to every 786 inhabitants. Massachusetts followed next, with the District of Columbia, New Jersey, Rhode Island and New York in the order named.

The number of applications for patents received during the year 1897 is the largest in the history of the office, yet in all probability the number will be exceeded in the coming year.

The influence of patented inventions is most strikingly shown in the creation of new industries of enormous magnitude since 1880—that is, within the term of patents now in force or but very recently expired. Of these new industries the most noted are those directly connected with the development of electrical inventions, such as the manufacture of electrical apparatus and supplies, the supplying of electricity for lighting and power purposes, electric railways and the telephone.

The manufacture of electrical apparatus and supplies began to be of importance shortly before 1880, and in that year 76 establishments, employing 1,271 persons and producing an output valued at \$655,036, were in existence. In 1890 the number of establishments had increased to 189, employing 9,485 persons, and producing an output valued at \$19,114,714. The increase in this industry has been very great since 1890. No separate statement of electrical machinery exported is given in the statistics of exports for that year. In 1897 the exports of such machinery amounted in value to \$917,453. Besides this the exports of "instruments and apparatus for scientific purposes, including telegraph, telephone and other electric," amounted in value in 1897 to \$3,083,900, having increased to this amount from \$98,383 in 1880 and \$1,429,785 in 1890. In the electric light and power industry as reported in 1880 there were but three establishments in the United States, employing 229 persons and producing an output valued at \$158,400. In 1890 there were in the small portion of the country reported (the State of New York, the District of Columbia and the city of St. Louis), 144 establishments, employing 2,004 persons and producing an output valued at \$4,783,224. No statement of the extent of this industry in the whole country for the census year is available, but it is stated on what is believed to be good authority that in 1892 the aggregate capital invested in this industry in the United States was not less than \$350,000,000. At the close of 1894 there were in the United States 2,124 central stations supplying electricity for

light and power and 7,478 isolated plants, a total of 9,599 establishments. The capital invested in these central stations is stated to have been \$258,956,256, and the capital invested in the isolated plants, though not stated, was probably not below \$200,000,000. A conservative estimate of the number of persons employed at that time in this industry would not be under 45,000. The growth of this industry since 1894 has been steady and rapid. New central stations and new isolated plants have been put in use all over the country, and those already in use have been enlarged. The prospect of still larger growth in the future is assured.

The use of electricity for power purposes has found its most notable development in the electric railway. This is of very recent origin. The first electric

the United States up to October, 1897, was 13,765 miles, out of a total mileage of 15,718. The total capital invested was \$846,131,691.

The telephone is now recognized as a necessity of commercial life. The manufacture of the instruments has up to a very recent date been in the hands of the company controlling the original patent. Since the expiration of that patent the manufacture of telephones has become a considerable industry, but no statement as to its extent is available. The telephone in 1880 was just beginning to become commercially known. At the close of 1895 there were in the United States 927 telephone exchanges and 686 branch offices, using 459,728 miles of wire and employing 11,930 persons. The amount stated to be invested in telephone property was \$77,500,000.

The investment in electric light and power plants, in electric railways, and in the telephone represents to a large extent money paid for labor, either directly for the construction of buildings and the construction of railway roadbed, the stringing of hundreds of thousands of miles of wire, or indirectly in the manufacture of the materials and supplies necessary. The demand for copper, largely for electric purposes, has caused the output to increase from 60,480,000 pounds in 1880 to 265,115,133 pounds in 1890, of which nearly all was produced in the United States. In 1895 the copper produced in the United States, including that made from imported pyrites, was 392,639,964 pounds, valued at \$38,682,347.

It is to be noted with respect to the new industries based on patented inventions that none of them were immediately successful. The public is not quick to accept new inventions until their practical value has been amply demonstrated. The electric light was believed impracticable and its first installation was met by practical difficulties hard to be overcome. Only within a very few years has this light in either of its forms, the arc or the incandescent, become a light that could be depended on. The electric railway was accepted slowly, and its best type for city use, the conduit system, was first installed against the judgment of many of those believed to be best able to judge of its practical value. Even the telephone was at first believed, except by a few enthusiasts, to be nothing more than a toy.

None of the inventions on which these industries are based were in the form in which they were first patented commercially practicable. Even if it be conceivable that the primary inventions would have been made without the stimulus of the patent system, there would have been no inducement to inventors to spend time and money in perfecting and improving these inventions without the certainty that if made practicable and acceptable to the public their manufacture, use and sale could be controlled for a term of years through the protection afforded by patents. If a new device may be freely copied by rival manufacturers as soon as it appears upon the market, no one can afford to expend the large sums of money which are often found necessary in perfecting the invention, constructing the plant necessary for its manufacture, and bringing it before the public.

An international exhibition will take place at Dijon, France, from June to October, 1898. A special section is to be provided for electricity, and a new tariff has been fixed for the supply of power.

A SUCCESSFUL KENTUCKY GIRL.



MISS GLASCOCK, OF MAYSVILLE, KY.

Miss Glascock has been doing some very creditable electrical engineering work in her native State, and has recently submitted plans and specifications for an electric light plant to the City Council of Lawrenceburg. She has completed a plant at Morganfield and will superintend the construction of one in Nicholasville. Miss Glascock is a niece of A. R. Glascock of Maysville, Ky., where she makes her home.

street railway in the United States was put in operation little more than ten years ago. In 1880, of the 2,050 road miles of street railway in the United States nearly all used animal power. Electric power was not then used. Steam and the cable were used on a few miles. At the close of the year 1890 it is stated that the total mileage of street railways was 8,123 track miles, on 5,661 miles of which horses were used, the remaining 2,462 miles being mainly electric and cable. The capital invested in these roads was \$211,277,798, and 71,000 persons were employed on them. In 1894 the total mileage was 12,527, of which 7,470 was electric. The capital invested was \$648,330,755, of which \$423,493,219 was invested in electric railways. In 1896 the mileage had increased to 14,470, of which 12,133 miles were electric. The capital invested was \$784,813,781, and the number of persons employed was not less than 150,000. The total mileage of electric railways in

ELECTRICALLY OPERATED MOVABLE PLATFORMS FOR THE UNIVERSAL EXPOSITION AT PARIS.*

BY G. HAMELIN.

Among other important questions that the Commission of the Paris Exposition of 1900 is endeavoring to solve, is how to transport rapidly from one point to another the large number of visitors who are expected to be present. It is thought that there will be as many as 60,000,000 admitted. With such a large number of people, what would be the use of an electric railway or trolley that could at the most convey 10,000 travelers in both directions, especially at the end of the day when as many as 40,000 or 50,000 persons might be worn out sight-seeing and all anxious to get away? In the case of a railroad the wait between trains would be more or less long, depending on the headway at which the trains were run, and often at intermediate stations these trains would be obliged to pass without stopping, to the great disappointment of the travelers waiting at that station.

Among the various designs that have been submitted to the Commission of the Exposition, there is one that is especially interesting owing to its originality and the services that it will be called upon to render if it is adopted. This device is a movable electric platform having two different speeds, suggested by MM. Blot, Guyenet and De Mocomble. At the Chicago Exposition in 1893 a somewhat similar platform was in operation and gave general satisfaction; likewise during the last Exposition in Berlin a two-speed movable platform was erected for the use of visitors. It is necessary to go back to 1886, however, to find the origin of this system; at that time M. Blot took out a patent for an electric platform supported on rails operated by means of grooved pulleys upon which the rails rested. In 1889 M. Blot suggested the adoption of a platform based upon the same principle, but his proposition was rejected. M. Blot was, however, not discouraged, and after further perfecting his system took out another patent in 1895; M. Guyenet on his part also took out a patent on a platform somewhat similar to that of M. Blot. For the Exposition of 1900 MM. Blot, Guyenet and De Mocomble have adopted a combined system, consisting of a platform of two different speeds.

The plan consists as follows:

1. Of a high-speed platform of 1 meter in width, moving along a track having a gauge of .9 of a meter at a speed of 2.7 meters per second, or about 10 kilometers an hour.
2. Of a platform of reduced speed, .8 meter in width, moving along a track having a gauge of .45 meter at a speed of 1.35 meters per second, or at about half the speed of the platform previously mentioned.
3. Of a stationary sidewalk, .9 meter in width.
4. Of a narrow bridge in metal, supported by columns.
5. Of stairways to allow passengers to mount and descend.

Each platform is made up of a succession of trucks of two distinct types; the first is supported by 4 independent wheels; the second has no wheels, its extremities resting on the two neighboring trucks. The flooring is supported on wooden stringers which in turn rest on cross girders; the middle of each girder is fastened to an axial beam, the wheels of the trucks being situated at the extremity of the girders. The wheels run on iron rails, the latter being placed upon wooden stringers, which in turn rest upon iron girders. Every six meters the axial beam rests on cables some of which are stationary and only serve to sustain the system, while others are movable. A long beam would not allow of curves being readily passed over, therefore the axis or center beam has been divided into sections about 4 meters

in length, the joints being fastened securely together by means of hinges. This arrangement allows of curves with a radius of 60 meters being turned.

The rolling is made easy by the use of rubber springs which deaden the shock and noise. The propelling cables in turning cause the longitudinal beam to advance through adherence alone. The propelling cables are located 39 meters apart. At Chicago the system was so arranged that all the movable apparatus was drawn along, which in case of repair necessitated the stopping of the platform.

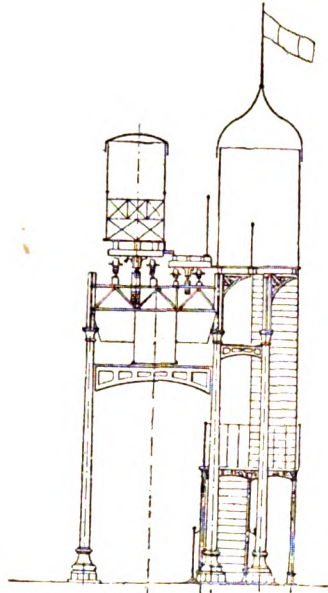


FIG. 1.
Transverse section of a station of the electric platform for the Paris Exposition of 1900.

In this case, however, the propelling apparatus being stationary could be readily examined without in any way interfering with the operation of the system, which in itself is a decided advantage. The propelling cables are operated by means of electric motors receiving current from a central power station. A stairway could be located every 200 meters to allow of persons reaching the fixed sidewalk of the platform, or movable inclined planes adopted such

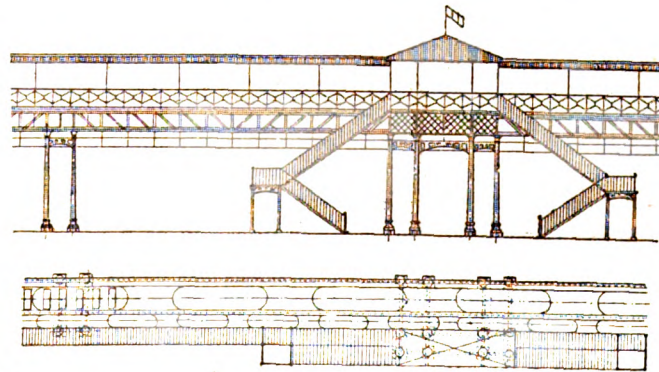


FIG. 2.
General arrangement of the proposed electric platform for the Paris Exposition of 1900.

as are now in operation in the Louvre department store.

The public might apprehend danger in passing from a fixed sidewalk to a movable platform, but in this case there would be nothing to fear as the slow moving platform would have a speed of but 5 kilometers an hour—about as fast as a person would ordinarily walk. It would be no more difficult to pass from the low-speed platform to that of high speed than in the former case, owing to the relative movement of the two. At Chicago, moreover, no accident of this nature was reported.

The platform would pass through a portion of the Avenue La Motte-Picquet, l'Esplanade des Invalides, the Quay d'Orsay, and would return to its starting point by the Avenue de Suffren, after having

traveled a distance of 4,200 meters (about 2.6 miles).

With the system just described as many as 50,000 persons could be carried each hour, or even as many as 60,000 were the high-speed platform slightly widened.

The above number is certainly a great improvement on the 10,000 which is the greatest number that could be carried by means of an ordinary electric road, and there is not the slightest doubt but what the system proposed by MM. Blot, Guyenet and De Mocomble is a step in advance and would effectually solve the difficult problem of rapid transit for the coming Exposition, without taking into consideration the fact that it would be another attraction among the large number already promised.

PURIFICATION OF THE ELECTROLYTE IN COPPER REFINING.*

Much mystery has been made concerning the methods for the purification of the electrolytes which are used in modern copper refineries. The common assumption by copper refiners of possessing esoteric information is partly responsible for this, but a larger and more permanent cause is the very variable character of the material refined. It is evident that the soluble impurities derived from the crude copper anodes, which eventually find their way into the electrolyte and there accumulate, will differ according to the nature and amount of the minor constituents of the crude copper; thus it comes about that general methods, based on single examples, are likely to be inapplicable in the same degree and for the same reason as many published analyses of anode sludge, fluctuating in composition with every alteration of the raw material, are misleading. It is not to be supposed that it is in any way difficult for a competent chemist to devise a satisfactory method for treating an electrolyte so as to recover whatever constituents are worth retrieving, to eliminate those which are worthless or noxious, and to restore the solution to a working condition, but it is nevertheless useful to have recorded the details of such methods as have been approved by practice. Therefore in this article we have translated from the German the essential portions of a paper by Titus Ulke,

which appeared in a recent number of the *Zeitschrift für Elektrochemie*, and have made such critical comments on the statements there set forth as seemed necessary.

In the first place the systematic control of the composition of an electrolyte for copper refining is requisite, both in order to avoid the deposition of foreign metals at the cathode whereby the quality of the copper would be impaired, and also to maintain the strength of the electrolyte at its proper point. The copper content of the electrolyte tends to increase because the copper at the anode dissolves rather more quickly than it would if its rate of dissolution were strictly proportional to the current. This is due to the fact that copper exposed to the joint

*From the *Electrician*, London

*Translated for *ELECTRICITY* from *La Vie Scientifique*, Paris.

action of air and sulphuric acid slowly dissolves, irrespective of its function as an anode; copper containing oxide will, of course, dissolve faster than the metal free from this body and dependent for its oxidation on the presence of atmospheric oxygen. The proportion of copper thus dissolved to the quantity of copper dissolved electrolytically will be greater the smaller the current density and the more vigorous the circulation and consequent aeration of the electrolyte. Spontaneous evaporation—not to be neglected when the electrolyte is used slightly warm; e. g., at 30°C. to 40°C. = 86°F. to 104°F.—also tends to increase the concentration of the electrolyte, and thus from these several causes it comes about that there is a continual tendency for the quantity of copper sulphate in the tanks to augment until an elimination of a portion of it is a necessity. It is evident from this that the purification of the electrolyte should be accompanied by a withdrawal of a portion of its main constituent, copper sulphate.

At the great copper refinery of the Baltimore Copper Company a definite portion (about one-fifth) of the electrolyte is removed from time to time to be worked up for copper sulphate, and a suitable (but not necessarily equal) amount of pure copper sulphate solution is added so that the content of the electrolyte in impurities is diminished, and, at the same time, the strength of the electrolyte in copper sulphate is adjusted to its normal value. The importance of this regulation lies in the fact that in a large refinery containing a multitude of small units of plant it is essential for smooth working that the conditions of current density, resistance of solution and the like should be maintained as nearly uniform as possible. It is for this reason that any process of purification which would regenerate the electrolyte continuously instead of periodically would present many advantages.

Using this method, the Baltimore Copper Company produce a considerable quantity of copper sulphate, which is sold with profit to the Western Union Telegraph Company. The final liquors are precipitated with iron scrap to recover the last portion of copper, amounting to 2 or 3 per cent.

A similar system is in use at the Balbach Works, Newark (U. S. A.), where a portion of the electrolyte is concentrated for the recovery of the sulphates of copper, iron and nickel, and the mother liquor is finally boiled down in order to obtain arsenious acid and sulphuric acid. This description is decidedly vague. An ordinary copper electrolyte is not likely to contain nickel in quantity sufficient to allow of its recovery as sulphate, for although it is true that nickel is a constant concomitant of commercial copper, yet it is also true that it is usually present in quantities not exceeding 0.2 to 0.3 per cent. Further, the recovery of the sulphuric acid by any practicable boiling down process is sufficiently dubious. The natural extension of the idea of the precipitation of the copper by means of iron to the recovery of the whole of the copper by this means, has not led to any valuable result. The precipitated copper is comparatively impure, and the ultimate product, ferrous sulphate, is of very small market value.

At the works of Guggenheim Bros., Perth Amboy, a process is in use approaching the ideal already set forth of a continuous purification of the electrolyte. The method is a modification of that due to K. and H. Borchers, in which the liquid of each individual tank is circulated and at the same time aerated by a jet of air at a pressure of 3 or 4 lbs. per square inch blown into a vertical tube open at the top and bottom to allow the electrolyte to enter below and to be ejected above, impelled thereto by the effective alteration of head produced by the injected air. The electrolyte, clarified from its impurities, is little liable to deposit foreign matter on the cathodes; such mechanical contamination, due merely to the use of a turbid electrolyte, and in no way connected with the electrolytic separation of metals other than copper at the cathode, may be highly injurious to

the quality of the copper ultimately obtained and should be strenuously avoided. When the Borchers process was first described extravagant eulogy was bestowed on it. In particular it was said to cause the elimination of iron and arsenic from the electrolyte, and to remove all necessity for circulation of the electrolyte from vat to vat in the usual manner. These claims cannot be admitted, but nevertheless aeration and internal circulation of the electrolyte of each vat are useful, and yield excellent results when supplemented by occasional circulation of the liquid from tank to tank. In spite of this continuous partial purification the electrolyte at Perth Amboy needs periodical replacement. The liquor is run into lead-lined vats, and boiled with scrap copper with free access of air, so that the copper may be dissolved, the free acid neutralized, and the solution so enriched in copper sulphate that it can be readily crystallized to yield this salt. The copper sulphate is deposited on lead strips hung across the crystallizing tank. The mother liquor contains almost the whole of the antimony and arsenic, together with a small quantity of copper. The latter is precipitated by iron plates, on which the arsenic is also deposited as soon as the copper has been thrown down. Ultimately a black precipitate, containing as much as 60 per cent. of arsenic, is obtained. This may be worked up either for crude copper or for the production of arsenic compounds, such as Scheele's green, Paris green and white arsenic. In the Chicago Copper Refinery the bulk of the copper sulphate is recovered by crystallization, and the mother liquor is boiled down to a point at which both copper sulphate and arsenious acid crystallize out. The mixture is extracted with just enough water to dissolve the copper sulphate, which, being thus fairly freed from arsenic, is returned to the vats.

In the foregoing cases a part of the whole of the electrolyte is worked up for copper sulphate, and this purified recovered salt is returned to the process. Other methods have been proposed for the direct elimination of the chief impurities in the electrolyte and its restoration to a proper working condition without recourse to crystallization of the whole quantity of copper sulphate. These include boiling the liquor with metastannic acid to precipitate arsenic, filtration of the liquor through a layer of cuprous oxide, which is a base strong enough to precipitate most foreign metals as hydroxides, and oxidation of some of the impurities, notably iron, by aeration, and consequent precipitation of certain other impurities, e. g., arsenic as ferric arseniate. All these methods singly and conjointly have met with very poor success. Purification by means of tin added to the copper before it is cast into anodes, in the proportion of 2.5 lbs. per ton (say 0.1 per cent.), has also proved of only moderate utility. When the copper is very arsenical the tin in dissolving appears to retain the arsenic in the anode sludge, when it is less objectionable than in solution in the electrolyte; the presence of tin in the anode also makes the deposited copper smooth. These advantages, however, are not sufficient to make the application of the process generally remunerative.

One of the best methods of purification consists in electrolyzing the liquors from the depositing vats with a current density so high that all impurities save iron are deposited pell-mell with the copper. The operation is carried out in purifying tanks, of which a set of 12 is allotted to about 280 depositing vats. The cathodes in the purifying tanks are of sheet copper and the anodes are of lead. The process needs a somewhat large expenditure of current, and produces a good deal of impure copper; but it has the advantage that the copper is recovered as metal, which, though impure, is often more salable than is copper sulphate. The electrolyte, purified as regards arsenic and antimony, impoverished in copper, and still containing iron in solution, is brought up to strength with fresh copper sulphate and returned to the depositing vats, its purification and

return being repeated until the iron accumulates to an inconvenient extent, when the liquor is finally worked up for copper sulphate.

The variety of these methods makes it abundantly evident that there is no "best" or even standard process of purifying copper electrolytes, and that the merits of every suggested procedure must be considered not only from a chemical and technical point of view, but also with regard to local demands for by-products, such as blue vitriol and crude copper, and to local abundance of supplies of raw materials, such as sulphuric acid, scrap copper and the like. A process torn up by the roots, and transplanted to a distant site with different local conditions, is not likely to prosper.

ON THE MANUFACTURE OF LAMPS AND OTHER APPARATUS FOR 200-VOLT CIRCUITS.*

BY G. BINSWANGER BYNG.

(Concluded from page 151.)

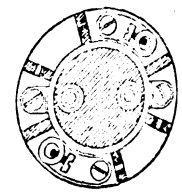
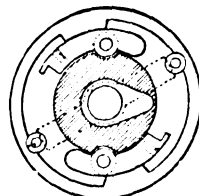
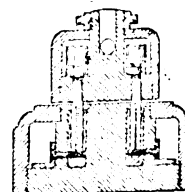
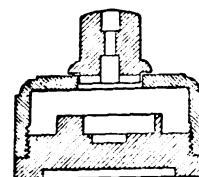
SWITCHES.

I come now to the matter of adapting switches, wall plugs, ceiling roses, lamp-holders and minor fittings.

I do not apprehend any difficulty in changing existing types from the present standard of use to conform to the higher standard, yet maintaining the same appearance and size, and, when sufficiently in demand, approximately the same cost. The chief alteration will be in the increased break and better insulation of the two poles. In smaller articles, such as combined switches and lamp-holders, the difficulty, if any, is more apparent. A discussion bearing upon the subjects involving the use and con-

H. V.
DOUBLE BREAK SWITCH.

H. V.
WALL PLUG.



H. V.
CEILING ROSE.

H. V. CEILING ROSE.
LINED CUT-OUT.

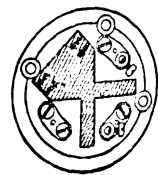
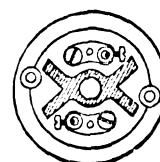
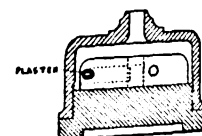
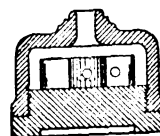


FIG. 1.

struction of double-pole switches, length of break, standardization of terminals, position of fuses, the carrying capacity of contacts, etc., would be, to my mind, of great value.

Without enlarging upon the subject of switches to an undue extent, I will show some specimens of different types I find to be satisfactory in practice.

Here (1) is a switch to take the place of the ordi-

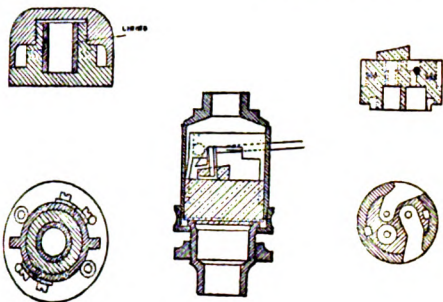
* Paper read before the Institution of Electrical Engineers, London, Eng., Feb. 24, 1898.

nary link or tumbler switch, and (2) here is an ordinary double-break china switch. You will notice the formation of the china base, and the separation and action of the metallic parts, which are arranged to produce a long break and perfect insulation, so that an arc cannot be maintained if established, nor can a shock be communicated to the operator. I have also placed there enlarged drawings of wall sockets and ceiling roses, to illustrate my further remarks under this heading.

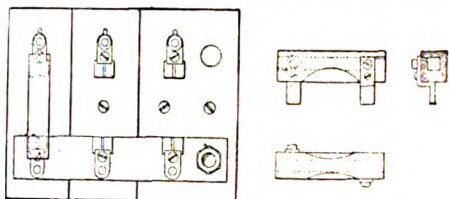
It is not necessary to go deeply into the subject of fixtures such as electroliers, pendants, etc., but in connection therewith I wish to refer to the question whether it is advisable to recommend the use of two or more low-voltage lamps in series on a 200-volt circuit. Within my own experience, I know of sev-

H. V. CHINA CUT-OUT.
LINED CHAMBER.

H. V.
KEY SOCKET.



H. V. CUT-OUT BOARD.
SPRING CLIPS FOR HOLLOW CHINA FUSE HOLDERS.



H. V. CUT-OUT BOARD
WITH LINED CHAMBERS.

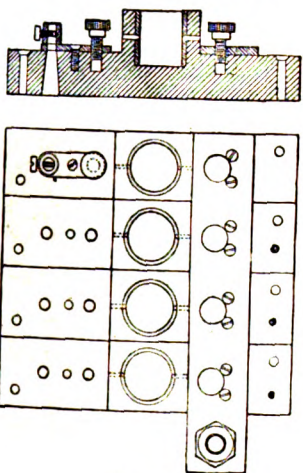


FIG. 2.

eral installations fitted originally with 200-volt lamps that have, by reason of greater expense for current, and an inferior light, been rewired for two 100 lamps in series, with satisfactory results. It is within the province of manufacturers to materially assist wiremen by designing fittings specially adapted to series wiring, such as series holders, ball fittings, brackets or electroliers with arms in multiples of two; and such a practice might be extended with advantage to many other details.

FUSES.

The question of fuses for higher voltage requires more careful investigation, and would repay thorough discussion. Central station engineers agree to differ upon the various points of efficiency, as evidenced by the different rules issued for our guidance. Some lay stress upon increasing the length of fuse wires, others insist upon ventilation holes, and in

some cases the height of covers is to be increased. But there is no unanimity between them, and none of these rules, in my opinion, indicates the right direction.

I have made some extensive experiments, and believe that the results are of interest to the profession generally.

When a circuit is opened by the disruption of a fuse, the combined metallic vapors and hot air produced by the high temperature of the resulting arc may extend and maintain it so as to bridge over the terminals, which, melting and becoming volatilized, feed the arc, and rapidly increase the temperature. I find, in practice, that under these conditions the china base supporting the fuse and terminals is easily volatilized also, and not only contributes towards the maintenance of the arc, but is ruptured as if by explosion, tending to set fire to any inflammable surroundings. This rupture has hitherto, I believe, erroneously been attributed to the expansion of air confined by the cover; hence the ventilation holes, which, according to my opinion, are useless. The same experiments tend to prove the fallacy of using a long fuse wire, with the concomitant disadvantages of finding space for it, and also difficulty in renewal; and I feel sure that full efficiency may be attained with a short fuse.

My deductions from the aforesaid experiments are that—

- (1) It is essential to arrange a fuse wire so that it will break at a definite part of its length, i.e., approximately, the center.
- (2) The arc formed on breaking the fuse must be so confined that it cannot be maintained so as to damage the terminals, base, or cover.

I will now describe how I have carried out these essential points in china cut-out boxes, which are the general type of fusible cut-outs used in house installations in this country.

These fuses are arranged on china bases, or in groups upon cut-out boards, and their carrying capacity varies from 1 to 100 amperes. In all these I provide what I call a "fuse chamber"—i.e., a round china wall forming a central hole, from $\frac{1}{2}$ inch to 1 inch in diameter—and this is pierced with two holes near to the terminals, which are fixed upon the base outside the wall. The wire is threaded through the holes from one terminal to the other, passing through the fuse chamber. Both ends of the fuse wire are supported by a material which is a better heat conductor than air, whilst it is free in the central fuse chamber. Thus the same current raises the temperature of the fuse wire within the fuse chamber more rapidly than at the supported ends, therefore the disruption takes place there, and the resulting arc is enclosed. I find, however, that china as an isolator is not sufficient, because of its tendency to volatilize under the high temperatures—a fact I have already mentioned. Therefore I line the interior of the chamber with another material which is a better heat conductor and less liable to fracture, and I find that ordinary plaster of paris is most convenient for this purpose, although several other substances may be equally efficient.

Fuses constructed on this principle require but a short length of wire, and are perfectly safe on high voltages, and the general appearance and size does not differ to any great extent from those now in common use. The principle once established of surrounding part of the length of fuse wire with a substance that is a better conductor of heat than air, we can easily construct any other type of fuse upon the same principle.

Fuse wires enclosed in glass tubes filled with plaster or cement, but with a free central space for fusion, for instance, fulfil the same conditions.

I find that such fuses have been patented by Mr. Mordey in 1890. The mere fact of enclosing a fusible wire in a non-conducting refractory filling would not fulfil the essential functions of a perfect fuse as I have described, without a clear space at or about the center for disruption. Mr. Mordey describes

such a space in his specification, but it is for the purpose of observation only, and it is not clear from the tenor of the specification that the inventor had this purpose of the localization of fusion in mind. Mr. Miller of Kensington has also altered the ordinary Edison fuse by substituting thin copper wire, and partly filling the center with asbestos fiber. So far as localizing the point of disruption and confining the arc, this fuse acts very well, although copper or alloyed fuses are not perfect under any circumstances, by reason of the maintenance of a dull red heat under normal load.

ARC LAMPS.

Coming now to the subject of arc lamps in relation to the higher pressure, I do not see that with alternating currents the increased potential materially affects the consumer. The practice may bring a single-parallel system into vogue, with economy coils—an alteration which will, in my belief, increase the commercial efficiency of alternating arcs. But the disadvantages are apparent in the case of a continuous current circuit. For instance, in small installations of one or two lamps on the 100-volt circuit, these must be doubled on the 200-volt circuit, or useless resistances interposed. To equalize the conditions it has been proposed to substitute low-current lamps—say four 5-ampere instead of two 10-ampere lamps.

As this substitute has been advocated by one of the foremost central station engineers, and many others will possibly follow him, it may be useful and not out of place to prove that both in theory and practice low-current arc lamps are deficient in points of economy and efficiency.

It is generally accepted that the current-density of an arc is independent of its size; assuming this as correct, the area of an arc must be proportional to the current, and the cooling surface proportional to its diameter. This is the case with the cooling surface of the carbons, if these are used of areas proportional to the current taken by the lamp. Thus the cooling effect of the atmosphere will have a direct relation to the diameter of the arc and to the square root of the current. Therefore, for illumination, large arcs are more efficient than small ones, and the practical arc is attained when the benefit of increasing the number of light centers balances the inefficiency of small arcs. This gives, in practice, an arc of about 10 amperes.

Small arcs worked under same conditions are more unsteady than large ones, which is due to the fact that with an arc of a given length the EMF. decreases as the current increases. An experiment in which a fixed length of arc at 5 amperes and 44 volts was suddenly increased from 5 amperes showed—

Normal.....	5 amperes	.....	44 volts
Sudden increase from 5 to 6 amperes.....	40.5 "		
" " " 5 " 7 "	38.5 "		
" " " 5 " 8 "	37.2 "		
" " " 5 " 9 "	36 "		
" " " 5 " 10 "	35.2 "		

So an arc, or series of arcs, with a total voltage approximating to the EMF. of the circuit is unstable and fluctuating—probably due to the disproportionate variations of the cooling surface, coupled with the decreased resistance of carbon at higher temperatures. If the arc flares, the current will increase, unless there is sufficient resistance in series to reduce the voltage across the arc at a greater rate than the above figures show. Certainly the mechanism tends to lengthen the arc, but to no advantage, because the movement continues until the current decreases to the normal value, and the acceleration would extinguish the arc unless an interposed resistance allowed of a rapid increase of the voltage across the arc. Such a resistance is necessary to compensate the "negative resistance" of the arc, which may be more appropriately termed "decreased cooling surface per ampere." An additional resistance in series is necessary to ensure steadiness. It follows, therefore,

that 5-ampere lamps must be worked on a higher EMF. or "pumping" will ensue.

The possible current through four lamps on 200 volts, allowing 40 volts across each arc, is 5 times the normal; with five lamps on 230 volts, 7.6 times the normal; while with four lamps on 230 volts it is only 3.3 times the normal. Therefore, when 5 ampere lamps are used upon a 230-volt circuit, it is better to run four with steady long arcs than five with unsteady short arcs.

It is probable that the enclosed arc lamp will be brought into prominence in this direction, offering certainly many advantages; but I would point out that in practice the current cannot be largely increased, because of the fragility of the enclosing envelope under an accession of temperature. If the cooling surface be increased so that the temperature of the gases surrounding the arc remain about the same, the efficiency of the lamp is considerably reduced.

Adverting to the manufacture and installing arc lamps to meet the contingencies of the high voltage, we have to consider that, if the carbons run short or the slides stick in one lamp, the other lamps close together, and the full voltage of the circuit is maintained across the shunt coil of that particular lamp. The possible troubles are that the shunt coil is burnt up, and that the carbon-holders are damaged with the excessive flaring of the arc before it breaks.

It would hardly be practical to make magnets to stand such overload. Of course we can install a cut-out and equivalent resistance to each lamp. But this expedient is very costly, and presents the further difficulties of finding suitable room near the lamp or making it self-contained with the lamp, and of teaching the consumer that the full current can be used although the lamps are not alight.

Some sort of cut-outs must be installed, and I am of opinion that there is a field for inventors in this direction. I will indicate how I have endeavored to meet these difficulties.

If, as is generally the case, one pair of carbons burn at a greater rate than the others, the slide in that lamp will touch the stop first, and the stumps will burn away until the gap is wide enough to break the arc. I append a table showing the results of five trials:

FOUR 10-AMPERE LAMPS ON 200 VOLT CIRCUIT.

+ carbon 18 mm. corod. — 11 mm. solid.

- | | | |
|-----|---|----------|
| (1) | Arc flared and was extinguished at..... | 1½" gap. |
| (2) | " " " " " " " " " " " " | 1¼" " |
| (3) | " " " " " " " " " " " " | 1" " |
| (4) | " " " " " " " " " " " " | 1½" " |
| (5) | Current switched off when arc was at... | 2½" " |

In the first four trials the arc broke while flaring; that is to say, it traveled up the side of the carbon and ignited the loose dust, taking a spiral course, this course being continued until the length is too great for the voltage. The arc only leaves the point of the carbon when there is sufficient dust to maintain it and counteract its increasing length; thus, when the supply of dust fails, the arc is extinguished before it can return to the points.

During trial No. 5 the carbon became pointed and the temperature rose to the extent of freeing the surface from dust, hence the arc did not leave the crater.

We deduce from this the desirability of maintaining a considerable gap between the carbon-holders, exceeding even 3 inches. For absolute safety it is better to extinguish the arc automatically. Now an automatic switch is useless, because it is necessarily controlled by the potential across the lamp, and could not discriminate between the increased voltage caused by the carbons burning short and that caused by the extinction of a flare; and, since this may happen at any time, the arc could not be re-formed even when the carbons came together. The circuit, in fact, would be inert, and the arc would have to be re-established by hand.

An efficient cut-out must extinguish the arc, and simultaneously cut the shunt coil out of the circuit,

the mechanism of the lamp also being free that the carbons may travel together. The shunt must on no account be cut out whilst the brake is on, since it could not then compensate the series coil and draw the carbons together.

For the protection of the shunt coil I have used a temperature fuse made of an alloy with a melting point of 210° Fahr., and having sufficient sectional area to be independent of the amount of current likely to traverse it. The carbons could be held apart several minutes before fusion took place. Although a decided advantage was gained over a plain lead fuse, and the shunt coil was efficiently protected, the carbon-holders were not protected, and the fuse required renewing each time it became ruptured.

The chief difficulty in constructing an automatic "cut-in" and "cut-out" lies in the necessity for a rapid make or break, to save vibration and sparking. My system may be briefly explained, in that the arc is first short-circuited through a shunt path, and so put out by reducing the voltage across the terminals. This short is then broken by a quick break switch, the same action reversing the shunt switch simultaneously, ready to fall upon its normal contact when the carbons touch or are replenished. The mechanism is actuated by the main armature of the lamp, and the movements take place while the armature is below the feeding point, so as not to interfere with the working of the lamp.

HEATING AND MOTORS.

The effect of the increased pressure upon such applications of the house current as heating, cooking, etc., does not entail a sufficient alteration structurally or electrically to need an exhaustive description.

The resistances forming or causing the heating surfaces must be arranged to conform to the higher EMF. at the terminals, and it is mostly preferable to increase the length rather than decrease the diameter of the resistance wires; but this fact presents some difficulty in such articles where the space available is small. If the space is too limited, such apparatus can only be used in series, or in connection with an external resistance.

With motors, the greatest difficulty also lies in adopting the smaller sizes, say from one-twelfth H.P. to one-sixth H.P., to suit the altered conditions of higher pressure. A certain structural alteration is doubtless necessary to arrange a new winding to produce the same efficiency as heretofore on a 100-volt circuit. In the larger sizes, I am, in order to facilitate keeping stock, using a double or differential winding, which, when coupled in parallel, conforms to 100 volts pressure, and with the same winding in series gives an equal efficiency on a normal load at the 200-volt pressure.

In reviewing the subject of higher voltage generally from a standpoint of cost, I am of opinion that sufficient time and experience naturally resulting from an increased demand will place the cost of most fittings for 200 volts within the margin of those of the lower voltage—except, perhaps, a few cases, among which I may instance incandescent lamps. These will necessarily always be more expensive, owing to increased cost in mounting of larger bulbs and extra supports, and also through increased time of exhaustion and percentage breakage.

But we must not overlook the fact that in the matter of wiring there must be a decided saving. The smaller sectional area of conductor per lamp employed, without the necessity of increased insulation, as also in a minor degree smaller connectors and contacts, will in all probability compensate some other apparent disadvantages, and may bring the balance of cost in favor of the high-voltage system.

I do not wish to bring the subject of cables and wires or wiring systems within the scope of my present paper; but I will only mention that, in my opinion, such matters as the establishment of revised wiring tables, the use of twin wires, the smallest gauge allowable for single lamps, the best and

cheapest system of wiring for high-voltage supply, would be subjects well worthy of the immediate consideration of, and an interchange of opinion between engineers and manufacturers.

ELECTRICAL EXHIBITION NOTES.

Mr. Fred Catlin, the manager of the Telegraphic tournament, has completed the preliminary arrangements for that contest, and has arranged the classes. Circulars on this subject will be ready this week for general distribution, and there is already a great demand for information on the subject from all parts of the country. Mr. Catlin informs the Exhibition management that the entries will probably be more numerous than at any other tournament that has occurred, and thinks that some of the records will be phenomenal. It is proposed, in addition to the regular contest, to have interesting exhibits of telegraphic skill in novel directions. Mr. Jesse H. Bunnell, the electrical manufacturer and veteran operator, is taking a deep interest in the contest, and has volunteered to equip the whole stage with the necessary apparatus for the competition in the shape of keys, sounders, batteries and auxiliary appliances. Mr. Bunnell is desirous to have a separate prize offered for an "old timer's class," and has already entered himself for that contest. He has the reputation, dating from the war, of being an unusually fast and skilful operator.

Mr. H. V. Parsell, the well-known banker of this city, who has long been interested in electro-deposition work has kindly placed in the hands of his son, Mr. H. V. Parsell, Jr., the electrical engineer, for exhibition at Madison Square Garden during May, a marvelous collection of galvanoplastic work, done during a long series of years. It may be doubted whether any other amateur could possibly show anything approaching this remarkable collection in beauty and interest. It will not only include several striking pieces, as large as 25 inches by 25, reproducing celebrated works of art and famous men, but will comprise a large number of coins, medals and facsimiles of antique gems. The most extraordinary part of this collection, however, will be that which embraces the reproductions from natural objects. It is safe to predict that there will be a crowd around these exhibits all the time. The manner in which they are made, for example, is of deep interest. There are, for instance, snakes and frogs which have been made to the life and from the life. The snake is etherized under a bell jar, then taken out and greased with sweet oil and replaced in the bell jar while a sufficiency of thin plaster is mixed with warm water. The snake is then placed on a glass plate and posed. Around him is built an enclosure of four square bars, and the plaster is slowly poured over the snake, the bars confining the cast in a rectangular shape. When the plaster is hard, it is freed from the sticks and glass plate and the now defunct reptile is carefully removed tail first from his intaglio impression. The plaster cast thus obtained is rendered waterproof by immersion in molten paraffin. A metallic conducting surface must now be given to the interior of the cast. This is done by moistening the surface of the mould with a solution of silver nitrate and by exposure to sulphuretted hydrogen, precipitating the silver on the cast. A conducting wire is now fastened around the edge, and the mould is carefully suspended in the depositing bath. A good firm coating takes about three days to form, and then the mould is softened in boiling water and carefully broken off.

People have often heard of the incinerating effects of high frequency currents, but rarely get any practical demonstration. The attention of the electrical and daily press has lately been drawn to the grim fate of various birds that had in an unfortunate moment perched on some of the high tension wires of the power transmission circuits in California. Mr. George P. Low, the well-known electrical engineer of San Francisco, has preserved the remains of two eagles, some storks and other birds which had short-circuited part of the current while sitting on the wires, with the result of leaving only their beaks and talons, not a vestige of their bodies and feathers being discovered. Mr. Low is forwarding these curious relics to the Electrical Exhibition, where they will be mounted in such a position as to show how the

thing happened and just what happened. It will be the first exhibition of the kind that has ever been made.

It is proposed at the Exhibition to have amongst other railway apparatus a working model of track intended to demonstrate the operation of the third-rail system as applied to steam railroads. Col. N. H. Heft, the electrical engineer of the N. Y., N. H. & H. Railway Company, whose work is so widely known in connection with the third-rail line between Hartford and New Britain, Conn., has very kindly placed at the disposal of the management blue-prints showing the construction of the track and some of the actual material used. The model track, from 50 to 100 feet long, single and double, and about 5 inches gauge, is now being constructed on Col. Heft's plans, and will be shown in actual operation during the continuance of the show, the details of the track being imitated as closely as the conditions will allow. Over this track a train of cars will run to and fro continually, showing how the current is picked up and delivered to the motor and how the switches and signals are included in the operation.

A Two Hundred Mile Electric Railway.

We stated in our last issue that the passage of an ordinance by the city council of Kenosha, Wis., enabled the building of the only remaining link in an electric railway from Chicago to Green Bay, Wis., a distance of 201 miles. This is explained by the fact that a portion of the road is already covered by tracks, and the Kenosha franchise was the last required to complete the right of way. The new road is being built by piece work. About sixty miles of the track of the Fox River line, connecting Milwaukee and Green Bay, will, it is said, be laid next summer and fall, and many miles of construction work were completed during the winter. The Milwaukee, Racine & Kenosha Electric Railway is in operation from Milwaukee to the Kenosha city limits on the north, covering a distance of thirty-five miles. Another piece of the system is an electric line connecting Waukegan and North Chicago, lying four miles to the south of Waukegan. Between Waukegan and Evanston a good many miles of track have been laid. The distance from Evanston to Chicago is covered by the Chicago, North Shore Electric and the Chicago, Milwaukee & St. Paul. Though the latter road is operated by steam it is soon to be equipped with electricity, so that an entrance to Chicago from Evanston can probably be secured without great difficulty. The Fox River line will reach Milwaukee very shortly after the frost leaves the ground. The sixteen miles construction between Kenosha and Waukegan will require no longer than three months' time at the outside, and while that bit of track is being laid the connection between North Chicago and Evanston will be accomplished.

The charter of the Milwaukee, Racine & Kenosha road permits the carrying of passengers, baggage and express, but it is understood the Fox River line between Milwaukee and Green Bay intends doing a freight business also. Its passenger cars will be almost as weighty as an ordinary steam railway coach and carry motors of double the power of those used on the ordinary heavy electric railway coach.

Removed to Better Quarters.

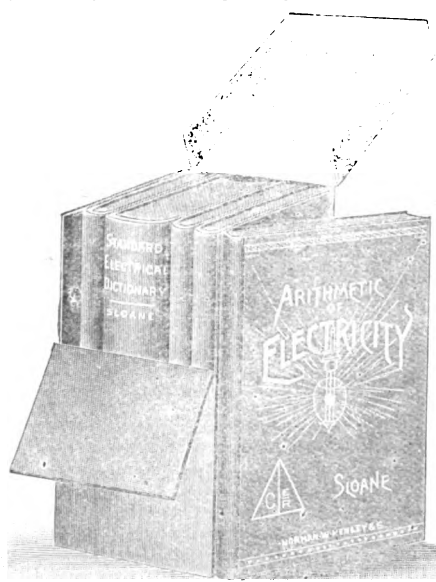
The Eureka Tempered Copper Works of North East, Pa., have rented spacious quarters for their New York office at 107 Liberty street, where they have placed a large stock of their celebrated commutator bars, with drop forgings and cast, new and assembled commutators, all types of knife switches, lugs, wire gauze brushes, segments and brushes for arc lighting; and are equipped for furnishing practically everything in the copper line demanded by the electrical trade. In their new location they are better able to meet the demands of their large Eastern trade than ever heretofore, and contemplate a large increase in their already well-established business.

The Joint International Meeting at Laredo, Tex.

The joint meeting of the Texas Gas & Electric Light Association, the Texas Street Railway Association and Mexican gas, electric light and street railway men, at Laredo on the 9th, 10th and 11th inst., was one of the most successful meetings of gas and electric men ever held in Texas. Several papers on subjects interesting to the delegates were read and discussed, and the question of amalgamating the two associations named was decided in the affirmative, the name selected for the new organization being the Southwestern Light & Street Railway Association, and its territory covering all the Southern States and Mexico. Several excursions were provided for those attending the meeting, and a superb band from the City of Mexico, which was present by the courtesy of President Diaz, regaled the delegates and the citizens with the finest music ever heard in the town. A committee was appointed to prepare and design a silver plate to be presented to President Diaz for his courtesies extended to the International Convention. The committee on permanent organization reported the following officers for the ensuing year, and they were unanimously elected: Carl F. Drake, president; J. H. Fitzgerald, first vice-president; E. Duestrow, second vice-president; W. H. Weiss, third vice-president; E. L. Wells, secretary; F. Fries, treasurer. The Association will meet next year at Aussin.

Good Books for Electrical Students and Others.

Norman D. Henley & Co., of 132 Nassau street, New York, the well-known publishers of electrical and scientific books, are handling a large number of new and valuable works that should prove of interest to electricians and all other practicable people. Among others the above firm have recently published and are offering a set of five of Prof. T. O'Connor Sloane's works, entitled respectively "Arithmetic of Electricity," a practical treatise on electrical calculations of all kinds; "Electricity Simplified," which describes electrical phenomena in a way that can readily be understood by anyone; "Electric Toy Making," a work especially intended for ama-



teurs; "How to Become a Successful Engineer," which was especially prepared with a view to guiding young men who cannot afford a collegiate education, and Prof. Sloane's well-known "Standard Electrical Dictionary," brought thoroughly up to date. The five books are enclosed in a neat box. The regular price of the set is \$7. They offer the set complete, if ordered at one time, at \$5.

This set of books, as will readily be seen, covers the field of electricity very thoroughly, and will be found indispensable to persons interested in electrical science. Those desiring books of any practical nature would do well to send to Norman D. Henley & Co. for their large 96-page catalogue, which covers every branch of practical science and will be sent free on request.

LEGAL NOTES.

George H. Little has applied to the Circuit Court at St. Louis for a writ of mandamus to compel the officers of the Chicago & St. Louis Electric Railroad Company to allow him to see the books of the company. The company was formed some years ago for the purpose of building an electric railroad between St. Louis and Chicago, but the matter was not put through, as predicted at the time by *ELECTRICITY*. It was a stockjobbing scheme of the most transparent character, and the wonder is how anybody could have been induced to invest in it. An examination of the books will serve a useful purpose, but it is doubtful if the men who paid for their shares will find any consolation in it.

At Atlanta, Ga., Judge Lumpkin recently granted an order authorizing the foreclosure of a mortgage of \$24,500 principal and \$5,097.62 interest in favor of D. H. Livermore and held by J. F. Leary, against the Atlanta Electric Railway Company. Judge Lumpkin's order is a result of the case of D. H. Livermore for the use of J. F. Leary against the Atlanta Electric Railway Company, and the foreclosure of the mortgage practically means that the property will be sold at an early date. The mortgage covers all the properties of the street railway company, 14,935 feet of track, including its franchises, power houses, rolling stock and equipments, and its donations of land and all property of every kind now owned or hereafter acquired by the company.

In the case of James P. Fay against the Galveston City Railway Company and Receiver R. P. Baer, for \$40,000 damages for the death of a child, a verdict was given in the United States Court at Galveston, Tex., on the 12th inst. in favor of the plaintiff for \$13,500. The suit had its origin in a street car accident in which a little child was killed and its mother injured. The case was brought into the Federal Court by reason of the car company's property being operated under a receivership created through the United States Court.

CANADIAN NOTES.

There is a good deal of favorable criticism of the kindly action of the Royal Electric Company of Montreal in coming to the assistance of the Laachine Rapids Company, whose power house was burned during the first part of the present month. The Royal lighted Westmount and Mile End for its competitor without charge for several days.

The Electric Reduction Company of Buckingham, Que., have placed an order with the Canada Electric Company for a 1,000 horse power revolving field generator to be used for electrolytic work.

The Welland, Ont., Aqueduct & Power Company has been organized with a capital of \$25,000 to supply electricity for light, heat and power.

Engineer Leyden of the Cataract Power Company has submitted to the city engineer of Hamilton, Ont., a proposition for running the sewage disposal works by electric power, but at present it is not known whether this scheme will be adopted.

Proposals Invited.

The U. S. Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until April 5th for furnishing the Norfolk, Va., Navy Yard with 1,000 electric lamps, 16 cp.; 800 Edison lamps, 32 cp.; 60 pounds fuse wire, 1 to 80 amperes; 50 pounds solder, wire; 10 bottles Yagers soldering salts; 400 pieces cut sheet mica; 400 hard vulcanized fiber washers; 100 Edison fuse plugs; 20 midget 2-wire cut-outs, and other supplies.

Blank proposals can be obtained upon application to Edwin Stewart, Paymaster General U. S. Navy, Washington, D. C.

The General Electric company owed on January 1, 1898, \$1,389,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What Is Going On in the Electrical World.

STREET RAILROADS.

Albany, N. Y.—Among the bills passed in the Assembly last week was Mr. Eldridge's, providing that the State Railroad Commission may approve in whole or in part an application of a street surface railroad company for permission to construct its road.

Brooklyn, N. Y.—The Brooklyn Heights Railroad Company has made arrangements to put down new and improved rails on nearly forty-five miles of its tracks within the next six months, at an expenditure of \$600,000. The new rails will be laid on the Flushing and Graham avenue line, the Bensonhurst line, the Third avenue line, the Crosstown line and Court street line.

Chicago.—John C. Schaffer of this city is reported to be organizing a scheme for an electric air line railroad from Detroit to Toledo. The road is to be built after the most approved pattern of steam roads and will cost, including equipment, about \$500,000. Chicago, Pittsburgh and Detroit capitalists are interested in the scheme.

Danville, Cal.—A survey is being made of a route for an electric railway to run from Haywards to Danville, with an ultimate terminus at the summit of Mount Diablo. A branch road will connect at San Ramon and run to Livermore.

Delaware, O.—B. W. Brown and associates, who recently bought the Delaware Street Railway at the receiver's sale for \$24,000, have returned the property to the receiver. Their purchase was conditioned on an extension of the bond time and the retaining of stock by some of the old stockholders. Both conditions failed and the sale was declared void.

Delhi, N. Y.—An electric railroad is projected between Delhi and Bloomville. "It is calculated," says the Middletown "Argus," "that the road could be built and equipped for \$9410 a mile and that the road will earn \$22,630 a year and can be operated and maintained at a cost of not exceeding \$9,360, thus leaving a net profit of \$13,270. Among the items of earnings is 500 cans of milk a day, which at five cents a can would yield \$9,125 a year."

Doylestown, Pa.—The Bucks County Railway, by vote of the stockholders, has been leased to the Doylestown & Willow Grove Traction Company.

Dover, Del.—The route for the proposed electric railway between Milford and Dover has been surveyed and work on the line is expected to begin very soon. The road will pass through Frederica and Camden, and steamboat connections will be made at Milford. It is also proposed to extend the road to Slaughter Beach, on Delaware Bay, and make steamboat connections for Philadelphia and Cape May.

Dudley, Mass.—The selectmen have signed the franchise to the Webster and Dudley Electric Railway. The \$5,000 of the road as per stock taken has been paid in and deposited in the local National Bank.

Lewiston, Me.—The Electric Railway Company has signed a contract with the Cabot Manufacturing Company at Brunswick for 1,000 horse power. The Cabot Company expects to have the requisite machinery in place and the transmission line completed so as to furnish power to the railway by the 1st of July.

Manchester, N. H.—In the report of the New Hampshire Railroad Commissioners, just issued, the financial condition of the various street railroads is stated and nearly all of them are making fair profits. There are seven street railroads in the State, having an aggregate of 74 miles of track. The total capitalization is \$1,650,219.

Philadelphia.—The trolley road to the League Island Navy Yard, built by the Union Traction Company, has been thrown open to the public. The power for the new line is supplied by feed cables from the power house at Thirteenth and Mount Vernon streets.

Plainfield, N. J.—The Plainfield Street Railway Company, which has been using power from the Plainfield Electric Light Company's station, will erect a power-house for its own use.

Providence, R. I.—The Inter-State Electric Street Railway Company, operating a long line in this State and the Attleboros, is contemplating the erection of a power house. At the present time the road gets its power from a Pawtucket concern, and it is understood that the officials of the electric road have decided to erect a fine plant of its own at some point along the line, either in Pawtucket or in one or the other of the Attleboros.

Rome, N. Y.—It is probable that the long talked of connection of Rome and Utica by electric railway will become a fact before the summer season is over. The Utica Suburban Railway Company has filed a certificate of extension of its road in the direction of Rome with the county clerk, and this is taken as an indication that the project will be put through at once.

Shenandoah, Pa.—The reorganization of the Shenandoah Street Electric Railway Company has been effected by the election of Hamilton Godfrey of Reading as president, H. C. Geisner of Reading vice-president, J. W. Johnson of Shenandoah treasurer, and Dr. H. D. Rentchler of Ringtown secretary. This railway will connect Shenandoah with Ringtown and other towns in the Catawissa Valley.

St. Joseph, Mich.—A syndicate of capitalists, headed by Col. George H. Allers and Milton Weston of New York City, have applied for a franchise for an electric road to enter Renton Harbor. The line will run east to Sister Lakes, Dowagiac and Kalamazoo and is to be completed early in July.

Valparaiso, Ind.—The county commissioners of Porter County have granted a franchise to the Hobart & Western Electric Railway Company to build and operate an electric road through Porter County. The line will be known as the Valparaiso, Flint Lake & Chicago Electric Road. It will go through the principal towns in the county and also connect with East Chicago, Whiting, New Chicago, Hammond and Hobart.

Woonsocket, R. I.—The property of the Blackstone Valley Street Railway Company has been sold by the sheriff to satisfy a judgment in favor of John A. Courtemanche, the builder of the car barn of the road. The property was knocked down for \$2,733 31 to Thomas F. Sullivan of Millbury, who acted for the company.

LIGHTING PLANTS.

Caldwell, O.—This town has decided to issue \$2,000 in bonds to complete its waterworks system and \$7,000 for a new electric light plant.

Cripple Creek, Col.—The Hayden Electric & Mining Company, which was recently granted a franchise by the city council, has begun the work of setting its poles in the streets of the city and has announced that everything will be in readiness for supplying the city with light inside of 60 days.

Des Moines, Ia.—The House has passed the McCaskey-Holcomb curative act, and the bill has gone to the Senate. If the Senate passes it, the city of Des Moines will be able to complete the contract with the McCaskey-Holcomb Company for the erection of the municipal lighting plant.

Lamar, Col.—The citizens will vote April 5 on a proposition to grant a franchise for an electric light and steam-heating plant and telephone exchange.

Mantua, N. J.—An electric light plant will be established at Jessup's Mills for the purpose of lighting Mullica Hill, Jefferson, Alcyon Park and adjoining towns.

Mercersburg, Pa.—The citizens of this place are preparing to put in an electric light plant which will be run by water power two miles distant.

Newark, N. Y.—The Legislature has allowed an appropriation not to exceed \$20,000 for a new power house at the Custodial Asylum. The building will include a dynamo room for the electric lighting of the institution.

New Paynesville, Minn.—The proposition to erect waterworks and an electric light plant was carried at the recent election. Bonds for \$8,000 will be issued for this purpose.

Oakland, Md.—At the election held here on the 14th inst., the vote was more than three to one in favor of issuing bonds to the extent of \$30,000 for the purchase of the electric light plant and building waterworks.

Ocala, Fla.—The city council has decided to erect a new electric lighting plant and appointed a committee to prepare plans and specifications.

Pittsfield, Me.—F. L. Smith of the firm of Smith & Conant Bros. states that his firm, if granted the right by the town, will put in a lighting plant at once to furnish 30 arc lights and 1,500 incandescents.

St. Paul, Minn.—Members of the city council are discussing the advisability of introducing an ordinance with the view of creating a municipal lighting plant; the plan contemplates lighting the entire city with electric light.

Starkville, La.—The executive committee of the board of trustees of the A. and M. College have ordered the erection of a two story shop building and the equipment of the physical and electrical laboratories, including a dynamo for lighting the buildings and grounds of the college with electricity.

Vicksburg, Mich.—At the election here on the 14th the ticket favoring waterworks and electric lights was the only one voted for.

Wesson, Miss.—A committee, including Mayor Buckley, is making investigations with a view of getting an electric light plant of sufficient capacity to light the city.

MANUFACTURING, ETC.

Cleveland, O.—The Navy Department at Washington has placed a very large rush order with the Jandus Electric Company of this city for the "Jandus" (formerly called "Manhattan") enclosed arc lamps.

Johnstown, Pa.—The Stinemans Coal & Coke Company has closed a contract with a Chicago firm to equip their colliery No. 2, at South Fork, with a complete electric haulage plant.

Lynn, Mass.—Thirty-six men employed in chipping castings at the River Works of the General Electric Company, have gone out on strike. The "Item" states that "a year ago Superintendent Fish made an agreement to pay \$2.80 a ton for chipping, piece work, with an hour rate of 15 cents per hour. This has been paid, but lately the company has cut the price. Last week the men were paid at the rate of 14 cents per hour. This week they were to be paid at the rate of 13 cents per hour. This was more than the chippers were will-

ing to stand, and they struck. Now they demand a rate of 18 cents per hour."

Peru, Ind.—The Electrical Manufacturing Company, finding its present quarters inadequate, is preparing to erect another large building. The product of the plant consists of electrical supplies.

COMPANY MATTERS.

Annapolis, Md.—A bill has been introduced in the Legislature incorporating the Heat, Light & Power Company of Baltimore. The incorporators are Joseph P. Smith, Bertram S. Morrell, John William Kaiser, Bernard J. Narthan and Theodore E. Dollard. The capital stock is to be \$10,000. The company is empowered to construct and operate overhead wires for illuminating purposes and also to furnish motive power for machinery and for such other purposes as electricity may be used.

Bridgeport, Conn.—The Crocker Electrical Company is about to open offices here and will be prepared to furnish all lines of electrical supplies, dynamos and motors. E. C. Crocker, who is at the head of the new concern, is one of the best known electricians in the State.

Columbia, S. C.—The People's Electric Light Company has elected the following directors: Frank P. Carpenter, L. Melville French, George Wallace, Aretas B. Carpenter, Alvin F. Sortwell, all Northern capitalists, and B. L. Abney and E. W. Robertson. A meeting of the directors will be held in Boston soon and the organization of the company then perfected by the election of officers. Application will be made to the city council of Columbia for permission to run wires through the streets. The electricity will be secured from the Water Power Company.

Grand Rapids, Mich.—The Peninsular Light, Power & Heat Company has filed an amendment to its articles of association reducing its capital stock from \$20,000 to \$10,000 and the number of shares from 800 to 400.

Naugatuck, Conn.—A. M. Young, president and treasurer of the Naugatuck Electric Light Company, has bought the entire holdings of B. G. Bryan in the company, giving him a controlling interest. The plant will be enlarged and improved.

Newark, N. J.—The Cassidy Electrical Switch Company has filed articles of incorporation with the county clerk. The object is to manufacture and sell electrical machinery and otherwise engage in electrical business, with the principal office in East Orange. The capital stock is put at \$100,000, with \$1,000 paid in, and the incorporators are John C. Cassidy, Pottiel R. Bomeiste and Howard K. Wood, all of East Orange.

Newport, R. I.—The two companies which held charters granting rights to run an electric railway from Newport to Fall River have united under the name of the Newport & Fall River Electric Railway Company. The companies which consolidated to form the new company are the Fall River & Stone Bridge and the Middletown & Portsmouth railway companies. The officers of the new company are: President, Stillman F. Kelley; treasurer, E. L. Saltonstall; secretary, Albert C. Landers; directors: Stillman F. Kelley of North Cambridge, Mass.; William A. Tucker of Boston; Melville Bull of Middletown; A. C. Landers of Newport; A. L. Handy of Tiverton; Lorenzo D. Tallman of Portsmouth; Robert S. Geoff of Fall River; E. L. Saltonstall of Newton, Mass., and E. P. Shaw of Brookline, Mass.

Sault Ste. Marie, Mich.—The Edison Sault Electric Company will build a large power building this summer, increasing its present capacity fully five times and giving it an abundance of cheap power to lease to manufacturing industries that may locate here. The improvements will cost \$75,000 and work will commence soon.

TRANSMISSION PLANTS.

Grafton, W. Va.—A Pittsburg syndicate is negotiating for the purchase of the Valley Flouring Mill property in this vicinity. It is the intention to erect a large electrical power plant. The best water power in the State is located near the desired property.

Pittsburg, Pa.—E. W. Linforth of San Francisco, who has been in this city for several days, stated to a reporter of the "Post" that the 108 mile transmission plant which involves the erection of a dam across the Kern River in Kern County, Cal., was sure of completion. The Kern River, according to Mr. Linforth, drains 2,345 square miles of territory, and the dam that is now under course of construction will give the company a total of about 12,000 horse-power. The voltage of 30,000 proposed for the line is a very high one, but, says Mr. Linforth, the high and dry atmosphere and the infrequent rainfalls warrant its adoption. The electricity generated will be transmitted to Los Angeles and other Southern California cities. The plant will cost in the neighborhood of \$500,000, and the Westinghouse Company, it is expected, will furnish the necessary machinery.

San Francisco.—A special to the "Call" from Fresno says: "The city of Hanford will this week have the proud distinction of being the terminus of the longest electric transmission power system in the world. Power is derived from the north fork of the San Joaquin River and delivered in Fresno, a distance of thirty-six miles from the generating station, and utilized there for light and power purposes. This system has now been extended to Hanford, a distance of thirty-three miles, and there will be utilized for light and various power purposes under a pressure of 19,600 volts. This electric installation is the longest line and the highest voltage

in the world to-day. With the improved machinery in vogue the use of such a high voltage has been made perfectly practicable. In the transmission of this power such a long distance (sixty-nine miles) the theoretical loss is phenomenally low, being only from 10 to 15 per cent., which also includes water-wheel loss at the generating station. Under the improved methods of adjustment of the machinery at the station the power is as well secured to the city of Hanford as it is to Fresno, notwithstanding the fact that Fresno is thirty-three miles nearer the source of power."

Tuscumbia, Ala.—A. F. Walker, a well-known engineer of Atlanta, has been at Mussel Shoals, ten miles above Florence, for several days making surveys for the electric light, heat and power plant projected by a recently organized company composed of a half dozen of Sheffield's most enterprising citizens. It is understood that Mr. Walker is very favorably impressed with the location, and is confident that almost unlimited power can be developed. The purpose of the company is to supply power, light and heat to towns and manufacturing within a radius of 100 miles of Sheffield.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—The Committee on Electricity, Gas & Water Supply of the Assembly has reported favorably Mr. Striefler's bill requiring gas, light and electric companies which require a deposit from their customers to pay interest at a legal rate on such deposits.—Governor Black has signed Senator Ellsworth's bill which exempts railroad companies from that provision of the corporation law which prevents corporations from incurring liabilities in excess of their paid up stock.—The Assembly has passed Mr. Holbert's bill authorizing municipal officers of cities of the third class to contract for the lighting of streets for a period not exceeding five years.—The West Oneonta and Laurens Railroad Company, with a capital stock of \$750,000, is to build and operate an electric road five miles in length from West Oneonta to Laurens in Otsego county.—Mr. Hatch has introduced in the Assembly a bill amending the stock corporation law to allow an electric light company to also furnish heat and power.

Ballston Spa.—At a meeting of the board of directors of the Ballston Terminal Railroad, Frederick H. Beach was chosen president. An early completion of the road is now expected.

Glens Falls, N. Y.—The Glens Falls, Sandy Hill and Fort Edward Street Railroad Company has decided to double its electric power. The additional buildings will be erected as soon as the frost is out of the ground.

Schenectady.—C. P. Steinmetz of the General Electric works will deliver a lecture on electricity, March 30, before the Historical and Art Society of Albany.—At the banquet of the Board of Trade in this city on the 17th, Edwin W. Rice, Jr., third vice president of the General Electric Company, spoke on "The Industrial Outlook." He said that if the present crisis is passed safely the commercial outlook will be most favorable. He believed that the success of this country lies in the cheapness of raw material, the skill of American workmen and the ability of American manufacturers.

PERSONAL AND MISCELLANEA.

Sir Henry Bessemer, the well-known inventor, whose discovery of a method of converting iron into steel revolutionized the iron trade, died on the 15th inst. at his suburban residence, 165 Denmark Hill, London. He was born in Hertfordshire in 1813.

Otto Kelm, a former employee of the Edison Electric Light Company in New York, has been placed in the Trenton Insane Asylum by the officials of Warren Township, N. J. Kelm is twenty-six years old. He had applied himself to the study of electricity so steadily that it affected his mind, and he became possessed of the hallucination that he was greater than Edison and could make improvements on the latter's inventions.

Lord Sackville Cecil, brother of Lord Salisbury, the English Premier, whose death occurred recently, left a fortune of \$1,250,000, almost entirely of his own earnings. He had an absorbing interest in electricity and was connected with several electrical enterprises. He assisted in the development of the Eastern Telegraph Company and was at one time chairman of the Exchange Telegraph Company.

A press dispatch from Buffalo, N. Y., states that the Boughton Telephotos Company is working day and night to complete a big order for their system of signals to be placed on the United States war vessels. The order came from the Navy Department a few days ago. The telephotos is said to be the most effective night signal known. It consists of four double lanterns hung vertically and lighted by powerful incandescent lamps. The upper half of each lamp is white and the lower half is red. An operator on a ship spells out the signals on a machine similar to a typewriter.

The battleships Kearsarge and Kentucky, now approaching completion at Newport News, Va., will be launched on the 24th inst. The Kearsarge will be christened by Mrs. Winslow, the wife of Lieutenant Commander Winslow, the son of the officer commanding the old Kearsarge in her memorable fight. The Kentucky will be christened by Miss Bradley, the daughter of the governor of Kentucky. Besides the usual electrical equipments, the turrets of these ships will be turned and controlled by electricity—the first instance on so large a scale on any vessel.

The Portland "Oregonian" says: "The prospect is very good for all the ships visiting this port having

their cargoes put on board or unloaded by electricity before long. Capt. J. A. Brown has already several conveyors operated by electricity for putting wheat and flour on board ships. He also has automatic ballast hoists on the Star Sand Company's wharf and at the Gas Company's wharf operated by electricity, by means of which ballast and coal are hauled with great rapidity and automatically dumped in elevated bunkers, so that wagons can be driven underneath and loaded by gravity. He has had electric wires run to a number of wharves so that his conveyors can be used wherever desired. It is quite probable that before long all the wharves will be electrified, and electric motors will have taken the place of the donkey engine in furnishing power for loading and unloading vessels. In the case of ballast ships this, with the elevated bunkers for receiving the ballast, will effect a large saving in the matter of shoveling, wear and tear of docks, etc., and in addition the work will be expedited."

The Pond Lily Company have installed at their works in Westville, Conn., says the New Haven "Leader," "a means of stopping all the machinery of the laundry department by the single touching of an electrical button, which is a big improvement upon the method now in use in some plants of electrically telegraphing the engineer to shut down his engine, or as in other plants of electrically closing the throttle valve of the engine in case of accident. Both of these methods have the defects of the loss of valuable time in actually stopping the machinery, as the momentum of the fly-wheel causes the line shaft to make many revolutions after the engine has been actually shut down, and if a person be caught in any of the belting or machinery, the chances are he or she would be considerably, if not fatally, injured before the machinery actually stopped, but by the new method devised by Harry F. Barnes the main line shaft is disconnected, and there being no balance wheel, with its stored up momentum, to overcome, the shafting and consequently all the machinery stops at once. Any one at all familiar with the operating of machinery, will see how perfectly this 'means to ends' works. It gives the operator on machines freedom from ever present fear, that otherwise inseparably attends the constant working about machinery in action, as each operator knows that by touching a button all the machinery stops at once. The buttons are distributed all about the factory, and to mark their location more quickly are painted a bright red, and also to prevent meddlesome interference, the word 'Danger' is conspicuously placed below the button."

RECENT COMPANY ELECTIONS.

Brush Electric Light & Power Company, Columbus, Ga.—The old officers and directors were re-elected.

Columbia Railway Company, Washington, D. C.—Directors: R. F. Baker, E. G. Davis, R. D. Weaver, Nathaniel Wilson, A. B. Coppes, John Cammack and George W. Moss.

Columbus Railroad Company, Columbus, Ga.—President, John F. Flournoy; vice-president, J. Wainwright; secretary and treasurer, Pierre W. Briggs; superintendent, W. D. Keene; directors: C. B. Grimes, Tol V. Crawford, L. F. Garrard, John F. Flournoy, W. D. Stratton and E. J. Kelly, of New York, and J. Wainwright, of Philadelphia. The same officers and directors were elected for the North Highlands Railroad Company of Columbus.

Greenbush & Nassau Electric Railway Company, Rensselaer, N. Y.—President, W. D. Barnes; treasurer, Thomas W. Cantwell; secretary, Dr. S. C. Curran; superintendent, Fred. Carr; directors: William D. Barnes, Fred. Carr, Thomas D. James, Jared L. R. Davis, George Whitlock, Gardner Morey, Sylvanus C. Curran, Lewis Miller, John Garrison, Joel Morey, Thomas W. Cantwell, W. Cocheu, William Nichols, Warren Fowler, Edwin S. Comstock.

Long Island Electric Railroad Company, Brooklyn, N. Y.—President, A. R. Hart, of Brooklyn; vice-president, Charles A. Porter, of Philadelphia; treasurer, William L. Wood, of Jamaica, N. Y.; secretary, J. C. von Arx, of Brooklyn; directors: Charles A. Porter, Jr., and F. M. Harris, of Philadelphia; A. G. Greenberg and Joseph Horgan of New York, and H. A. Van Allen, of Jamaica.

Petersburg Electric Railway Company, Petersburg, Va.—President, Edward C. White, New York; vice-president, Lloyd Nash, Westport, Conn.; secretary and treasurer, W. P. McKee, Petersburg; directors: the officers and Alexander Hamilton, Petersburg. Negotiations are pending with capitalists in Petersburg and the North looking to rebuilding and re-equipping the road.

Plainfield Street Railway Company, Plainfield, N. J.—President, Thomas Nevins; vice-president, Dr. T. J. Fritts; secretary and treasurer, Adrian Riker; superintendent, John Alderman; directors: Chandler Riker, Thomas Nevins, Jr., Dr. Fritts, M. B. Brown, Thomas Nevins, Sr., Courtland Riker and Adrian Riker.

Worcester & Clinton Street Railway Company, Worcester, Mass.—President, A. S. Paton; vice-president, Jerome Marble; treasurer, Walter R. Dame; directors: Alexander S. Paton, W. S. Reed and George R. Damon of Leominster; Walter R. Dame of Clinton, and Jerome Marble, T. S. Johnson and George A. Flagg of Worcester.

Worcester, Oxford & Webster Street Railway Company, Worcester, Mass. (a new organization).—Directors: J. L. Currier, O. F. Joslin, Albert M. Phillips, William C. Pierce, Leander F. Herrick, H. W. Aiken and C. H. Stratton. Mr. Aiken was chosen temporary chairman and clerk and Mr. Currier temporary treasurer. It was voted to take steps to secure franchises in the several towns.

The General Electric Company owed on January 1, 1898, \$1,339,580 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

COMMERCIAL PARAGRAPHS.

The Beacon Lamp Company of New Brunswick, N. J., the well-known manufacturers of high-grade incandescent lamps, have, we understand, been compelled to increase the capacity of their works owing to several large stations having recently placed contracts with them for their yearly supply of lamps. The excellent quality of the Beacon Company's product can be judged from the fact that the lamps the company have recently been turning out maintain an average candle power for over 300 hours, which is something unprecedented. We are authorized to say that the company will be pleased to furnish free to any prospective purchaser lamps for testing.

Educate Your Bowels With Cascarets.
Candy Cathartic, cure constipation forever.
10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

Gould & Eberhardt of Newark, N. J., report having had a gradual, steady growth in business during the past year, and now have a goodly number of orders ahead for their well-known Patented Special Machine Tools, which are fully up to date, some of the machines being away ahead of the present state of the mechanical art.

A Belt Dressing that Prevents Slipping and Preserves the Life of the Leather.

It is the slipping heel that wears the hole in the stocking and it is the slipping belt that wears the leather. Belts that slip not only do not drive properly, but they wear out rapidly. A belt that is too tight is overstrained, and will also wear out rapidly. A thoroughly reliable belt dressing is therefore a necessity in every well regulated factory, and probably no dressing has such a world-wide reputation as Dixon's Belt Dressing and Leather Preservative.

As long ago as 1878 it was used on the big driving belt at the Paris Exposition, when every other means had failed to make the belt take hold of the pulley that was to start the thousands of feet of shafting and hundreds of machines. Those who use Dixon's Belt Dressing claim that it prevents slipping and thoroughly preserves the life and elasticity of the belt. It is made only by the Joseph Dixon Crucible Co., Jersey City, N. J., who are known the world over for their graphite products.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c.
If C. C. C. fail to cure, druggists refund money.

No-To-Bac for fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c. \$1. All druggists.

Dr. Harwood Huntington has been appointed the official chemist of the Wool Exchange, and has moved his laboratory into the Wool Exchange Building, 260 West Broadway, where he has a large and beautifully equipped laboratory. The particular line of work in which this laboratory has done a great deal is the development of waste products, and the form of contract which is generally made with the clients is to take any waste product and make researches on it, and if nothing of practical utility results to make no charge. We feel sure that if this were more generally known among manufacturers of all branches of industry they would be glad to avail themselves of the opportunity offered by this laboratory.

Associated with Dr. Huntington is Dr. William H. Warren, who has had long experience in the manufacturing operations, and has been very successful in the development of new processes and finding applications for waste products.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

INCORPORATIONS.

The Crafton Storage Battery Company, Chicago, Ill.—to manufacture storage batteries. Capital stock, \$25,000. Incorporators: Charles B. Stafford, A. C. Crofton and J. K. Pumpelly.

The American Electrical Novelty & Manufacturing Company, New York. Capital stock, \$25,000. Directors: Conrad Hubert, Maurice Hartman and Joseph Harwich.

The George O. Towle Manufacturing Company, Lancaster, Pa.—to manufacture electrical machinery. Capital

stock, \$5,000. Directors: G. O. Towle, J. E. Hubley and R. Blickenderfer, Lancaster; G. A. Towle, Lowell, Mass., and J. P. Williams, New York.

The Canon City Ice, Light & Power Company, Canon City, Col. Capital stock, \$100,000. Incorporators: H. H. Shepard, M. M. Shattuck and H. H. Lee.

The Capital Electric Construction & Power Company, Washington, D. C. Trustees: George P. Phillips, William W. Walker, Robert P. Murphy and Hal P. Hill.

The South Milwaukee Electric Light Company, Milwaukee, Wis. Capital stock, \$15,000. Incorporators: William P. Cook, F. S. Pamperin and William Wiotte.

The American Electrical Novelty & Manufacturing Company, New York. Capital stock, \$25,000. Directors: Conrad Hubert, Maurice Hartman and Joseph Hurwich.

The Rockford Railway, Light & Power Company, Rockford, Ill.—to construct and operate street railways. Capital stock, \$250,000. Incorporators: F. A. Poor, N. B. Poor and R. S. Clements.

The Northern Electric Company, Auburn, Me.—to carry on electric light and power business. Capital stock, \$120,000. President, George C. Wing; treasurer, Herbert I. Goss.

The Chester Valley Electric Light, Heat & Power Company, Downingtown, Pa. Capital stock, \$25,000. Directors: Joseph R. Downing, John T. Fox, Guyon Miller, T. E. Parke, C. W. Walker, Edward Kerr and Joseph H. Johnson, of Downingtown.

The Indiana Heat, Light & Power Company, Mishawaka, Ind.—to manufacture gas and electricity. Capital stock, \$50,000. Trustees: Hugh H. Hoisford, John Tromp, J. M. Chillas, Archibald G. Graham and Edward A. Jernegan.

The Flushing & South Shore Railroad Company, Jamaica, N. Y.—to build and operate a standard gauge road, steam or electric, fifteen miles long, from Flushing to a point on the Long Island Railroad between Freshport and Woodburgh. Capital stock, \$50,000. Directors: William F. Brown, William L. C. Allen, Edward J. Boyle, George A. Hamilton, William J. Hawson, Matthew J. Kany and J. Holla Gibson of Brooklyn; Louis E. Freeman of Orange, N. J., and Francis L. White of Summit, N. J.

The East Greenwich Electric Lighting Company, East Greenwich, Conn.—to generate, conduct, sell, lease and use electricity for lighting, heating and mechanical purposes, and to manufacture, use and deal in all machinery, electrical instruments, conductors, lamps, apparatus and appliances pertaining to the use of electricity. Capital stock, not to exceed \$50,000. Incorporators: Charles G. Hill, Frank C. Cundall, Thomas H. Galvin, Samuel M. Knowles, Russell V. Sharpe, Joseph S. Thornley and others.

The Cumberland & Frostburg Electric Passenger Railway Company of Allegany County, Pa. Capital stock, \$50,000. Incorporators: John W. Burchinal and James E. Hooten of Mountville, W. Va., and Zachariah Lancy, Walter Powell and J. Henry Holzshu of Cumberland.—The Frostburg & Lonaconing Electric Passenger Railway Company, Frostburg—to build an electric road from Lonaconing to Frostburg. Capital stock, \$50,000. Incorporators: John W. Burchinal and James E. Hooten, of Mountville, W. Va.; Mark Wineland, Peter Lemmert and George H. Wittig of Frostburg.—The Lonaconing & Westport Electric Railway Company, Lonaconing—to build a road from Lonaconing to Westport. Capital stock, \$50,000. Incorporators: J. W. Burchinal, J. E. Hooten of Mountville, William Atkinson, Hugh Scott and George Terrett of Lonaconing. These three roads are to be connected. The reason that three separate companies were incorporated instead of one is that there is a state statute limiting the number of miles controlled by a turnpike company, plank road or passenger railway company to twelve, and the combined lines or any two of them will extend over that distance.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 15, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 630,527. Depressible-Rail System for Electric Railways. William Grunow, Jr., Bridgeport, Conn., assignor of one-half to Zalmon Goodsell, same place. Filed April 12, 1897.
- 600,554. Protective Appliance for Electric Railways. Louis E. Watkins, Springfield, Mass., assignor of one-half to Frank W. Dickinson, same place. Filed July 17, 1897.
- 603,633. Trolley. John Clayton, Cuyahoga Falls, Ohio. Filed Nov. 4, 1896.
- 630,515. Car Fender. George F. Radcliffe and John C. Slutz, Kansas City, Kan. Filed June 14, 1897.
- 600,601. Car Fender. William F. Young, Philadelphia, Pa., assignor of one-half to Henry S. Davis, same place. Filed Feb. 16, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 600,523. Quick-Break Electric Switch. Thomas E. Drogan, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed Nov. 13, 1897.
- 600,616. Alternating-Current Meter. George Hummel, Munich, Germany. Filed Oct. 30, 1897.
- 600,743. Automatic Safety Circuit-Closer and Cut-Out. Walter L. Pratt, Adams, N. Y. Filed May 13, 1896.

MISCELLANEOUS.

- 601,509. Controller for Electrically-Propelled Vehicles. Regina'd T. D. Brougham and Walter C. Bersey, London, England, assignors to the Electrical Vehicle Syndicate, Limited, same place. Filed Dec. 13, 1897.
- 600,607. Insulator-Support for Electrical Conductors. Fred Benedict, Niles, Mich. Filed Sept. 13, 1897.
- 600,693. Method of Making Soluble Metal Electrodes for Accumulators. Jules Julien, Brussels, Belgium. Filed Sept. 25, 1896.
- 630,719. Galvanic Battery. Emil Habermann, Michigan City, Ind. Filed Oct. 7, 1897.
- 603,765. Automatic Fire-Alarm. Robert J. Baker, Baltimore, Md., assignor of one-third to Joseph March, same place. Filed April 28, 1897.
- 600,819. Explosive-Engine. Alexander Winton, Cleveland, O. Filed June 26, 1896. Renewed Feb. 12, 1898.
- 600,850. Primary Battery. J. Ensign Fuller, New York City, assignor of one-third to George W. Munro, same place. Filed April 5, 1897.

TELEPHONE AND TELEGRAPH.

The Senate Finance Committee has decided to report a substitute for Senator Brush's bill reducing and regulating telephone rates throughout the State of New York. The substitute bill does away with the special commission to regulate telephone charges, etc., and places the matter under the supervision of the Railroad Commissioners and invests them with authority to investigate all complaints. The new bill provides that no telephone company shall make any charge for use or service of any telephone except the same be reasonable and just, or directly or indirectly charge, demand, collect or receive from any person or corporation a greater or less compensation for any use or service of any telephone than he or it charges or receives from any other person or corporation for a like and contemporaneous use or service under substantially similar circumstances and conditions, or refuse or neglect to furnish any reasonable telephone service to any person upon just and reasonable terms. Charges shall be deemed to be unreasonable and unjust if they are such as shall produce a net profit in excess of 10 per cent. on the cash capital actually paid in and property equivalent to cash computed on its actual value and invested surplus earnings, which cash capital, property and surplus earnings shall have been expended or employed in the business and be necessary to the efficient rendering of telephone services. The substitute bill was prepared by Senator E. R. Brown of Jefferson.

The minority report of the House Committee on Interstate and Foreign Commerce against the bill reported by that committee for the establishment of a Pacific cable has been completed. The original bill provides for a subsidy to the Pacific Cable Company at the rate of \$100,000 a year for twenty years, and provides for the completion of the cable to Honolulu by 1900, and to Japan and China by 1901. The substitute offered by the minority committee also provides for a subsidy not exceeding \$100,000, but it eliminates the name of the corporation, and has a provision for advertisement by the Postmaster-General and the co-operation of the Government of Japan.

The Committee on Department of Electricity in San Francisco has reported in favor of the establishment of a department of electricity in connection with the city government to have charge of the fire alarm, police telegraph and telephone systems, and to be under the control of a joint commission composed of the Fire and Police Commissioners. The joint commission shall appoint a chief of the department, who must be a skilled electrician, and also the necessary assistants.

It is stated that Gen. Miles has recommended the immediate connection of all the fortifications about New York with headquarters on Governor's Island by means of a submarine cable. Fifty miles of cable or more will be required as it will extend from Davids Island in the Sound to Sandy Hook, taking in en route Fort Schuyler, Willels Point, Governor's Island, Fort Wadsworth and Fort Hamilton. Both telegraph and telephone communications will be had through it.

Senator Lodge has introduced a bill as an amendment to the Naval Appropriation bill, calling for an appropriation of \$25,000 for the purpose of taking soundings between Honolulu, in the Hawaiian Islands, and the Empire of Japan and Australia, for the purpose of determining the practicability of the laying of a telegraph cable between the points named, and also authorizing the President to place a vessel of the United States for use in making such surveys.

The telephone war which has been raging in Columbia, Mo., for some months, has just closed in favor of J. A. Hudson, formerly editor of the *Macon Times*, and Thomas Gary of Macon, who owns several plants in North Missouri. They have purchased both of the Columbia systems and will consolidate the two and put in an entirely new plant. The line will be extended to Jefferson City, Fulton and other neighboring towns.

An effort is being made to establish a new telephone exchange in Watertown, N. Y. Frank A. Sherman has undertaken the management of the enterprise for the Shaver Telephone Company, and is endeavoring to secure the names of 150 patrons in order to secure its success.

The District Commissioners, in a letter to Senator McMillan, chairman of the Senate District Committee, have recommended adverse action on Senate bill 3,716, to authorize the Automatic Telephone Exchange Company (Limited) to construct, operate and maintain a telephone exchange in the District of Columbia.

The New State Telephone Company has been granted a 30-year franchise in Lapec, Mich., on condition that the city gets the use of two 'phones gratis for five years. The Bell 'phones will be thrown out.

A St. Joseph, Mo., dispatch states that the Missouri & Kansas Telephone Company is preparing to compete with

the Harrison Telephone Company by establishing connections in Northern Kansas and Southern Nebraska. All points on the Grand Island road will be covered by both companies.

The common council of Fond du Lac, Wis., has granted a franchise to the Eastern Wisconsin Telephone Company with the conditions that telephones for business houses be placed at a rental not to exceed \$2 per month, and for residences at not to exceed \$1 per month.

W. H. Kelley, of Newark, N. Y., has decided to establish a telephone exchange in the Horton block in that town as soon as the building is completed. Over forty persons have agreed to put in 'phones. The Newark Union says the service is bound to be first class with Mr. Kelley behind the project.

The Pennsylvania Telephone Company has perfected arrangements whereby its line will be extended from Chambersburg to Greencastle, Upton, Welsh-Run, Mercersburg, Penmar and Blue Mountain, thus connecting all the principal towns of the county with the county seat.

The Valley Telephone Company, Bay City, Mich., has ordered 1,500 telephones from the American Electric Telephone Company of Chicago for their Valley system. This order will be increased soon. The first 'phones will be placed in service in West Bay City in a few days.

A bill has been introduced in the Maryland Legislature for the reorganization of the Home Telephone & Telegraph Company of Baltimore, now in the hands of a receiver. The bill grants to the reorganized company all the rights and privileges held by the present company.

The Phoenix Telegraph & Telephone Company of Phoenixville, Pa., has made application for a new charter under the name of the Chester County Telegraph & Telephone Company. Its directors are Samuel W. Charles W. and Frank W. Gumbes, of Oaks, Montgomery county, and Thomas L. Hodges and William D. Bernard, of Philadelphia.

The longest telephone line will soon be in operation. It will extend from San Diego, Cal., to Nelson, B. C., nearly 2,225 miles. It will be twice as long as the longest line heretofore found practicable—that from Boston to Chicago by way of New York.

A company has been organized in Wallowa county, Oregon, to build a telephone line from Lostine to Paradise. The line will pass through Leap and Flora, and it is hoped to have it in operation within two months.

New Companies Incorporated.

The Tecumseh Telephone Company, Tecumseh, Mich. Capital stock, \$10,000.

The Juniata Telephone & Telegraph Company, Mifflintown, Pa. Capital stock, \$2,400.

The Union Telephone Company, Portland, Me.—Capital stock, \$10,000. Incorporators: G. A. Beaton and others.

The Inter-State Telephone Company, La Crosse, Wis. Capital stock, \$100,000. Incorporators: P. S. Elwell, George W. Bunge and Andrew Lees.

The Alvin & Angleton Telephone Company, Alvin, Tex. President, A. J. Birchfield; secretary and treasurer, O. S. Cummings; general manager, F. J. Bush.

The Lostine Telephone Company, Lostine, Ore.—Capital stock, \$1,500. Incorporators: E. W. Rumble, Guy E. McCully, W. S. Burleigh, A. E. Gray and H. C. Keefer, all of Lostine.

The Central Commercial Telephone Company, Bellefonte, Pa. Capital stock, \$25,000. The line will take in State College, Bellefonte, Lock Haven, Renova, Jersey Shore and Williamsport.

The Humboldt Telephone Company, Humboldt, Neb.—to put in a telephone exchange in Humboldt. Capital stock, \$1,000. Directors: Mayor A. H. Fellers, F. W. Samuelson, O. A. Cooper, E. A. Tucker and F. R. Butterfield.

The S. V. Interior Telephone Company, New York—to manufacture electric devices. Capital stock, \$30,000. Directors: R. G. Vassar, J. G. Smith, J. D. Anderson, W. B. Dall, C. C. Bean, G. Tait, C. A. Dall.

The Mutual Telephone Company, Ronceverte, W. Va.—to construct a telephone line from Marlinton to Monroe Academy, Pocahontas, Franklin, Lewisburg, Ronceverte and Greenbrier. Capital stock, \$10,000.

The American Typal Telegraph Company, Detroit, Mich.—to engage in the leasing, manufacture and sale of telegraph apparatus and the ownership and exploitation of rights in relation thereto. Capital stock, \$50,000, of which \$5,000 is paid in. Incorporators: James McMillan, Frank J. Hecker, Charles L. Freer and William F. Jarvis.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pl., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Mar. 21:							Hartford Conn.—Mar. 21:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q. Feb. '98.	133 1/2	134 1/2	Hartford Street Ry. Co.	100	\$4,000,000	\$200,000	3 % S. Jan., '98.	140	..
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q. Dec. 10, '97.	70	72	Hartford & West Hartford RR.	100	1,000,000	247,000	..	..	..
Traction Co. (Saratoga)	100	50,000	50,000	..	..	..	Holyoke Mass.—Mar. 21:						
Allentown, Pa.—Mar. 21:							Holyoke Street Ry. Co.	100	100,000	400,000	4 % A. Jan., '98.	200	205
Allentown & Lehigh Val. Trac. Co.	100	4,000,000	1,500,000	..	..	80	Hoboken, N. J.—Mar. 21:						
Bridgeport, Conn.—Mar. 21:							North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	..
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	Indianapolis, Ind.—Mar. 21:						
Baltimore, Md.—Mar. 21:							"Citizens' Passenger Ry.	100	5,000,000	5,000,000	..	25	26
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	72	78	Lancaster, Pa.—Mar. 21:						
Baltimore Consolidated Ry. Co.	25	10,000,000	5,177,000	2 % S., Jan. 15, '98.	22 1/2	22 1/2	Pennsylvania Traction Co.	100	10,000,000	9,900,000	..	..	..
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2	Lancaster & Col. Electric Ry.	100	..	87,500	..	..	..
Boston, Mass.—Mar. 21:							West End Street Railway	100	..	..	..	..	..
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..	Louisville, Ky.—Mar. 21:						
North Shore Traction Co.	100	4,000,000	4,180,000	..	18	..	Coulsville Ry.	100	1,000,000	3,500,000	1 1/2 % Q., Oct., '97.	35	38
North Shore Traction Co.	100	2,000,000	2,000,000	6 % S., A. & O.	77	80	Louisville Ry.	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	94	96
West End Street Ry. Co.	50	10,000,000	9,085,000	1 % S., Oct., '97.	40	60 1/2	Minneapolis, Minn.—Mar. 21:						
West End Street Ry. Co.	50	4,000,000	4,000,000	4 % S., Oct. 1, '97.	101	112	Twin City Rapid Transit	100	17,000,000	15,010,000	..	20	24
Boston Elevated R. R.	100	10,000,000	6,400,000	4 % S., Oct. 1, '97.	51 1/2	56	Twin City Rapid Transit	100	8,000,000	1,714,200	1 1/2 % Jan., '98.	..	100
Brooklyn, N. Y.—Mar. 21:							Montreal, Canada.—Mar. 21:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,403	2 % Feb. 1, 1898.	191	..	Montreal Street Ry. Co.	50	1,000,000	4,000,000	4 % S., M. & N.	260	+ 61
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	..	38	38 1/2	Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	51 1/2	100
Brooklyn Heights Railroad	100	200,000	200,000	..	..	..	Memphis, Tenn.—Mar. 21:						
Brooklyn City R.R.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	197	200	Memphis Street Railway Co.	100	500,000	500,000	..	15	..
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	..	..	..	New Haven, Conn.—Mar. 21:						
Coney Island & Brooklyn RR.	100	1,000,000	2,000,000	1 1/2 % Oct. 1, '97.	150	180	Fair Haven & Westville RR.	25	1,500,000	900,000	1 % S., Sept. '97.	57	60
Kings County Elevated	100	4,750,000	4,750,000	..	..	..	New Haven Street Railway Co.	100	1,250,000	1,000,000	2 1/2 % A., July '98.	60	80
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97.	47	50	New Haven & Centerville	100	700,000	800,000	..	..	..
Nassau Electric Railroad	50	6,000,000	6,000,000	..	40	..	Winchester Avenue RR.	25	1,000,000	600,000	..	40	42
Atlantic Avenue Railroad	50	2,100,000	2,000,000	..	74	80	New Orleans, La.—Mar. 21:						
Brooklyn, B. & W. E. Railroad	..	1,000,000	1,000,000	..	..	..	Anal & Claiborne RR. Co.	40	210,000	240,000	4 % S., Jan., '98.	140	158
Buffalo, N. Y.—Mar. 21:							New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	122 1/2	124
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	..	62	65	New Orleans Traction Co.	100	5,000,000	5,000,000	..	2	5
Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80	83	New Orleans Traction Co.	100	2,500,000	2,500,000	..	9	15
Columbus, O.—Mar. 21:							Crescent City RR.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	62
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	44	46	New Or. City & Lake RR.	100	2,000,000	2,000,000	4 % S., Jan., '98.	82	..
Columbus Central Street Railroad	100	1,500,000	1,500,000	..	..	..	Orleans Railroad	50	500,000	185,000	1 1/2 % June, '94.	16	21
Charleston, S. C.—Mar. 21:							St. Charles Street Railway	50	1,000,000	1,000,000	1 % Q., Jan., '98.	54 1/2	56 1/2
Charleston City Ry. Co.	50	100,000	100,000	8 % S., Jan., '97.	..	..	New York—Mar. 21:						
Enterprise City Ry. Co.	25	1,000,000	250,000	..	..	..	Central Crostown RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	220	..
Chicago, Ill.—Mar. 21:							Christopher & 10th Sts. RR.	100	650,000	650,000	2 % Q., Jan., '98.	155	165
Chicago City Ry. Co.	100	12,000,000	12,000,000	8 % Q., Dec. 31, '97.	..	232	Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	..	..
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	..	11 1/2	11 1/2	Metropolitan Street Ry. Co.	100	80,000,000	80,000,000	1 1/2 % Q., Jan., '98.	14 1/2	140
Lytle Street Elevated RR.	100	15,000,000	15,000,000	..	..	4	Bleecker St. & Fulton Ry. Co.	100	900,000	900,000	4 % A., July, '97.	34	55
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	..	..	..	Brooklyn & Seventh Ave. Ry. Co.	100	2,100,000	2,100,000	2 % Q., Oct., '97.	215	..
Met. West Side El. const. etc.	100	15,000,000	2,500,000	..	..	..	Can. Park, N. & E. Rivers RR. Co.	100	1,800,000	1,800,000	1 1/2 % Q., Jan., '98.	110	180
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., '98.	20	215	Eight Avenue RR.	100	1,000,000	1,000,000	..	320	330
North Chicago City RR.	100	800,000	249,900	..	..	..	Grand St. & Grand St. Ferry RR. Co.	100	750,000	748,000	4 % Q., Feb., '98.	330	350
North Chicago City Railway	100	2,000,000	1,603,200	..	..	..	Ninth Avenue RR.	100	800,000	800,000	..	180	..
West Chicago St. RR. Co.	100	20,000,000	18,189,000	1 1/2 % Q., Feb. 94.	91 1/2	91 1/2	Eleventh Avenue RR.	100	2,000,000	2,000,000	..	195	..
Chicago West Div. Ry.	100	1,250,000	624,900	35 %	..	..	Twentieth St. R. R. Co.	100	600,000	600,000	4 % Q., Feb., '98.	300	325
Chicago Passenger Ry.	100	2,000,000	2,000,000	5 % S.	..	..	Third Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	165	..
Cincinnati, Ohio.—Mar. 21:							42d St., Manhattan & St. Nich. Av.	100	2,500,000	2,500,000	..	174	178
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000	..	20	..	Union (Huckleberry) Ry.	100	2,000,000	2,000,000	..	65	74
Cincinnati Inc. Plane Ry.	50	150,000	150,000	2 1/2 % Q., Feb., '98.	..	75	Newark, N. J.—Mar. 21:						
Cincinnati, Newport & Gov. St. Ry.	100	4,000,000	8,500,000	..	23	25	Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	..	46	50
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	115 1/2	116	Newark Passenger Ry.	100	6,000,000	6,000,000	..	..	..
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.	..	..	Rapid Transit Street Ry.	100	504,000	504,000	11 1/2 % A.	185	195
Cleveland, Ohio.—Mar. 21:							Pittsburg, Pa.—Mar. 21:						
Akron, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000	3 % Jan., '98.	41	43	Allegheny Traction Co.	50	500,000	500,000	..	..	..
Cleveland City Ry.	100	8,000,000	7,600,000	3 % Q., Oct., '97.	59	60	Consolidated Traction Co.	50	15,000,000	15,000,000	2 % Jan., '95.	135	139
Cleveland Electric Ry.	100	12,000,000	12,000,000	3 % Q., Oct., '97.	60 1/2	61	Consolidated Traction Co.	50	15,000,000	15,000,000	3 % May, '97.	46 1/2	47
Detroit, Mich.—Mar. 21:							Central Traction Co.	50	1,500,000	1,900,000	..	..	..
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	..	100	..	Citizens' Traction Co.	50	8,000,000	13,000,000	6 % A.	61 1/2	..
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..	Duquesne Traction Co.	50	8,000,000	13,000,000	6 % A.	..	..
Rapid Railway Co.	100	250,000	250,000	..	..	100	Pittsburg Traction Co.	50	2,500,000	1,900,000	3 % Aug., '95.	..	..
Detroit Electric Railway	100	1,000,000	1,000,000	..	..	..	Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 1/2 % Jan., '98.	..	21 1/2
Wyandotte & Detroit River Ry.	100	250,000	200,000	..	100	110	Pgh. & Allegheny & Man. Trac. Co.	50	8,000,000	12,994,839	2 % Aug., '95.	..	..
Dayton, O.—Mar. 21:							Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	2 % Jan., '96.	13 1/2	13 1/2
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102	Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, '97.	..	..
City Railway Co.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98.	140	145	Second Avenue Traction Co.	50	4,000,000	14,000,000	..	..	..
People's Street Railway	100	1,100,000	..	..	100	..	Suburban Rapid Transit Co.	50	800,000	200,000	..	..	..

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Annapolis Street Railway, Baltimore & Potomac Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Potomac Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$200 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.
 j \$200,000 of stock owned by North Chicago Street Railroad Company.
 k Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 l \$80 per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$200,000 of stock owned by West Chicago Street Railroad Company.
 m Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 n Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Ry.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt & Pitts'h Trac. Co.
 p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 5 % on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4 % on capital stock after October.
 s Leased to Consolidated Traction Company for 1 % on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.	NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—Mar. 21:							Boston, Mass.—Mar. 21:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4% Q. Jan. '98.	247	249
Northampton, Mass.—Mar. 21:							Erie Telegraph & Telephone Co.....	100	...	...	1% Q. Jan. '98.	68 1/2	68 1/2
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	...	10,894,600	10,894,600	\$1.50 % Feb. '98.	122	125
Omaha, Neb.—Mar. 14:							New York.—Mar. 21:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co.....	100	14,000,000	14,000,000	1% Q.	...	90
Paterson, N. J.—Mar. 21:							*Central & South Am. Teleg. Co.....	100	5,500,000	5,500,000	1% Q.	104	107
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	185	190
Providence, R. I.—Mar. 21:							Franklin Teleg. Co.....	100	1,000,000	1,000,000	2% guar.	48 1/2	63 1/2
United Traction & Electric Co.....	100	8,000,000	8,000,000	1% Jan. '98.	59	62	Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q. Jan., '98.	71	76
Philadelphia.—Mar. 21:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	5,000,000	1% Q.	108	110
Fairmount Park Trans. Co...\$30 pd.	50	2,000,000	1,770,000	2% Dec. '97.	14 1/2	..	*International Ocean Tel. Co. guar. 6%	100	8,000,000	8,000,000	1% Q.	60	70
Hestonville, Man. & Fairmount.....	50	1,966,100	1,166,100	2% Jan. 15, '97.	44	45	Mexican Telephone Co.....	100	2,000,000	2,000,000	1% Q.	150	153
Hestonville, Man. & Fairmount.....	50	588,900	588,900	2% Jan. 10, '98.	61 1/2	65	*New York & New Jersey Tel. Co.	100	5,000,000	8,722,000	1% Q. Jan., '98.	71	76
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '98.	63	66	*Pacific & Atlantic Teleg. guar. 4%	25	2,000,000	2,000,000	2% S.	90	95
Union Traction Co.....\$12 1/2 pd.	50	30,000,000	23,930,450	.....	15 1/2	15 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	90	95
Electric Traction Co.....	50	500,000	1,192,500	\$3 share Q.	7 1/2	71 1/2	*South'n & Atlantic Tel. Co. guar. 5%	25	960,000	960,000	2% S.	111 1/2	113 1/2
*Citizens' Passenger Ry.....	50	1,000,000	1,000,000	\$14 share A—Apr. '97	80 1/2	80 1/2	*Commercial Union Telegraph Co.	25	500,000	500,000	8% S., Jan. 1 '98.	86 1/2	88
*Frankford & Southwark Pass. Ry.	50	1,000,000	1,000,000	.....	80 1/2	80 1/2	Western Union Telegraph Co.....	...	97,870,000	97,870,000	1% Jan., '98	120	122
*Lombard & South Street Ry.	25	1,000,000	1,000,000	A. & O.	89	90 1/2	Miscellaneous.—Mar. 21:						
*Second & Third Streets Ry.	50	1,000,000	1,000,000	\$9 share A, Mar. '97	265	..	American Dist. Teleg. (Phila.).....	25	400,000	400,000	1% Q. Feb. '98.	14	..
*People's Traction Co.....	50	10,000,000	10,000,000	3% A., April, '97.	185	..	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	178	176
*Greenmont Passenger Ry.....	50	1,500,000	1,500,000	\$5.25 share—1898.	132	..	Chesapeake & Potomac Teleg. Co.	100	...	...	...	50	55
*Green & Coates Passenger Ry.	50	500,000	500,000	.....	132	..	Chicago Telephone Co.....	100	...	...	...	202	..
*People's Passenger Ry.....	25	1,500,000	1,500,000	.....	132	..	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	750,000	750,000	.....	64	78
*People's Passenger Ry.....	25	1,500,000	1,500,000	.....	132	..	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1% Q.	74 1/2	80
*People's Passenger Ry.....	25	1,500,000	1,500,000	.....	132	..	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	112	117
*Philadelphia Traction Co.....	50	30,000,000	30,000,000	4% S—Oct. 1, '97.	79 1/2	80	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2% Q.	87 1/2	..
*Catherine & Bainbridge St.	50	1,000,000	1,000,000	6% A—Mar. '97.	185	145	Providence (R. I.) Teleph. Co.....	50	...	...	...	120	122
*Continental Pass. Ry. guar.	50	1,000,000	1,000,000	\$6 share—July, '97.	185	145	Southern New Eng. Teleph. Co.....	100	8,000,000	8,000,000	...	...	...
*Empire Passenger Ry. Co.	50	1,000,000	1,000,000	.....	185	145							
*Philadelphia City Pass. Ry.	50	1,000,000	1,000,000	.....	185	145							
*Philadelphia & Gray's Ry. RR.	50	1,000,000	1,000,000	.....	185	145							
*Ridge Avenue Passenger Ry.	50	750,000	750,000	.....	185	145							
*Philadelphia & Darby Ry. guar.	50	750,000	750,000	.....	185	145							
*17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	1,000,000	.....	185	145							
*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	1,000,000	.....	185	145							
*Union Passenger Ry. Co.	50	1,500,000	1,500,000	.....	185	145							
*West Philadelphia Pass. Ry.	50	750,000	750,000	.....	185	145							
Rochester, N. Y.—Mar. 21:													
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18							
Reading, Pa.—Mar. 21:													
Reading Traction Co.....	100	1,000,000	1,000,000	Semi-ann. Jan. & Jy	15	..							
*City Passenger Ry.....	50	850,000	850,000	Jan., '94.	111	..							
*East Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..							
St. Louis Mo.—Mar. 21:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec. 1888.	..	..					
Lindell Ry.....	100	2,500,000	2,400,000	1% Jan. '98.	120	122							
National Railway Co.....	100	2,500,000	2,479,000	1% Jan., '98.	..	..					
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000	1% Oct., '98.	90	110							
Citizens' RR.....	100	2,000,000	2,000,000	2% Jan., '98.	95	105							
St. Louis RR.....	100	2,000,000	2,000,000	1% Jan., '98.	170	172 1/2							
Missouri RR.....	50	2,400,000	2,400,000	50c., Dec. '89.	..	..					
People's RR. Co.....	50	1,000,000	1,000,000	.....	50	52 1/2							
Southern Electric Ry.....	100	1,000,000	1,000,000	1% Jan., '98.	100	102 1/2							
Southern Electric Ry.....	100	1,000,000	1,000,000	1% Jan., '98.	58	55							
St. Louis & Suburban Ry.	100	2,500,000	2,500,000	8% A., July, '98.	..	175							
Union Depot RR.....	100	4,000,000	4,000,000	8% A., July, '98.	..	175							
San Francisco, Cal.—Mar.													
California St. Cable RR.....	100	1,000,000	800,000	50c. monthly.	107 1/2	109							
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	58 1/2	..							
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	10							
Scranton, Pa.—Mar. 21:													
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12							
*Scranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	..							
*Scranton & Pittston Traction Co.	100	1,060,000	1,060,000	.....	9	11							
Springfield Ill.—Mar. 21:													
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11							
Springfield O.—Mar. 21:													
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2							
Springfield, Mass.—Mar. 21:													
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	205	210							
Toronto Canada.—Mar. 21:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1% S.	91 1/2	100							
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	260	261							
Washington, D. C.—Mar. 21:													
Belt Ry. Co.....	50	500,000	500,000	.....	25	..							
Capital Traction Co.....	100	12,000,000	12,000,000	55c. per sh. Oct. '97.	70 1/2	70 1/2							
Columbia Ry. Co.....	50	400,000	400,000	6% A.	7	75							
Eckington & Soldiers' Home Ry.	50	707,000	652,000	.....	..	..				
Georgetown & Tenallytown Ry.	50	200,000	200,000	.....	117	118							
Metropolitan RR. Co.....	50	1,000,000	418,900	2% Q.	..	..					
Worcester, Mass.—Mar. 21:													
*Worcester Traction Co.....	100	8,000,000	8,000,000	8% S, Feb., '98.	16	18							
*Worcester Traction Co.....	100	2,000,000	2,000,000	4% S, 1897.	91	95							
Worcester & Suburban Street Ry.	100	550,000	542,500	.....	85	..							
Wilkesbarre, Pa.—Mar. 21:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Lease to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to Union Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10% guaranteed by Reading Traction Company.
 n Dividend of 6% guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Mar. 21:									
Fort Wayne Electric Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....
Pt. Wayne Elec Co. T. Sec. Series A.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	82 3/4	83	.....	.....	.....
General Electric Co.....	100	10,000,000	4,252,000	8 3/4 % S., July, '98.	80	90	.....	.....	.....
General Electric Co.....	100	10,000,000	.....	.....	8 3/4	8 3/4	.....	.....	.....
T.-H. Elec. Co., T. Secur., Series D.....	50	.....	146,700	.....	21	22 1/2	.....	.....	.....
Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	4,996,053	1 3/4 % Q., Feb., '98.	53	54	.....	.....	.....
Westinghouse El. & Mfg. Co. pfd.	50	11,000,000	8,195,126	.....	.....	.....	.....	.....	.....
New York.—Mar. 21:									
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	188	183 1/2	.....	.....	.....
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/4 % Oct., '97.	105	107	.....	.....	.....
Edison Ore Milling Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....
Edison Electric Storage Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....
General Electric Co.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	82 3/4	88	.....	.....	.....
General Electric Co.....	100	10,000,000	4,252,000	8 3/4 % S., July, '98.	91	90	.....	.....	.....
Interior Conduit & Insulation Co.....	100	1,000,000	1,000,000	.....	41	.....	.....	.....	.....
United Elec. Lt. & Pow. Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg, Pa.—Mar. 21:									
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	107	.....	.....	.....	.....
East End Electric Light Co.....	50	800,000	800,000	8 % Q.	..	10	.....	.....	.....
Philadelphia, Pa.—Mar. 21:									
Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	.....	.....	.....	.....
*Electric Storage Battery Co. com.	100	8,500,000	.....	.....	21	22 1/2	.....	.....	.....
*Electric Storage Battery Co. pfd.	100	5,000,000	.....	.....	28	21 1/2	.....	.....	.....
*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97	41 1/2	22	.....	.....	.....
*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000	.....	6 % Oct., '97.	56	59	.....	.....	.....
Northern Elec. Light & Power Co..	10	6,000,000	550,000	\$52500 dis. Jan. 11 '97	18 1/2	14	.....	.....	.....
Southern Elec. Light & Power Co..	10	187,500	187,500	.....	10	.....	.....	.....	.....
Miscellaneous.—Mar. 21:									
Brush Electric Co.....	50	.....	.....	.....	82 3/4	85	.....	.....	.....
Bridgport (Conn.) Elec. Lt. Co....	25	500,000	.....	.....	.....	15	.....	.....	.....
Edison Illg. Co. (St. Louis).....	25	.....	.....	.....	118	125	.....	.....	.....
Eddy Electric Mfg. Co.....	25	.....	.....	.....	4 1/2	10	.....	.....	.....
Hartford (Conn.) Elec. Light Co....	100	850,000	.....	.....	148	.....	.....	.....	.....
Hartford (Conn.) Lt. & Power Co....	25	175,000	.....	.....	114	118	.....	.....	.....
New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	.....	149	150	.....	.....	.....
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	2 % Q., Oct., '96.	82 1/2	85	.....	.....	.....
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	114	118	.....	.....	.....
Royal Elec. Co. (Montreal).....	.....	1,000,000	.....	2 % Q.	149	150	.....	.....	.....
Toronto (Canada) Elec. Light Co....	100	1,085,000	1,085,000	1 1/4 % Q.	182 1/2	186	.....	.....	.....
Thomson-Houston Welding Co.....	100	.....	.....	8 % S., Dec. 1, '96.	90	100	.....	.....	.....
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....

BONDS.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Mar. 21, 1898.						
The Albany Ry.....1st mtg. 5s.	.....	\$29,000	1905			.....
The Albany Ry. Co.....Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*111	.....
The Albany Ry. Co.....Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....
Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*117½	.....
Watervliet Turnpike & RR..2d mtg. 6s	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co.....1st 5s	.....	.....	.....	.....	*107½	106½
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.

Date of Quotation—Mar. 21, 1898.

Baltimore City Pass. Ry. 1st mtg. g. 6s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	
Baltimore Trac. Co. Exten. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	104	107
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1912	J. & D.	116	
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000		1910	J. & T.	101½	
Baltimore Traction Co. Convertible 5s.	800,000		1916	J. & M.	103½	
Central Pass. Ry. Co. 1st mtg. 5s	96,000	117,000	1912	J. & J.	112	
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	112	
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119½	121

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.

†\$151,000 in escrow to retire 1st mtg. bds.

Boston, Mass.

Date of Quotation—Mar. 21, 1898.

Lynn & Boston RR. 1st mtg. g. 6s.	5,379,000	3,702,000	1924	J. & D.	102	105
West End Street Ry. Deben. g. 5s.	3,300,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	

†\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Mar. 21, 1898.

Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.		
Charleston City Ry. 1st mtg. 6s.	850,000			J. & J.		

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Mar. 21, 1898.

Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	103½	
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.		
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.		
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.		
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.		55
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	52
North Chicago St. RR. 1st mtg. 5s.	3,171,000	1,906,000	1906	J. & J.	101½	
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.		103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	
North Chicago City Ry. Consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103½	
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	101½	105½
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936		94½	97½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101½	

†Redeemable at option on 60 da. notice.

†Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.

†Subject to call after Oct. 1, 1899, at \$110 and interest.

†Assumed by W. Chl. RR. Co., lessee.

†Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Mar. 21, 1898.

Cin. New & Cov. St. Ry. 1st Con. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
†Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	
†Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	
†Mt. Adams & Eden Pk In. Cons. mtg. 6s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126½	

†Assumed by the Cincln. St. Ry. Co.

†\$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Mar. 21, 1898.

a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.		
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106½	107½
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000		1922	M. & N.	90	95
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co. Grand Rapids. 1st mtg. 6s.	600,000	600,000	1912	J. & D.	107½	

†\$1,900,000 in escrow to retire bonds of absorbed companies, marked a.

†Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Mar. 21, 1898.

†Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.		99
Fl. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	1907	A. & O.		
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	98½	99½

†\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven, Conn.

Date of Quotation—Mar. 21, 1898.

New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1911	M. & S.	104	
New Haven (Edgewood Div.) 1st mtg. 6s.	250,000	250,000	1914	J. & D.	102	
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1911	M. & N.	104	
Winchester Avenue RR. Deben. g. 4s.	1,000,000	94,000	1901	M. & S.	102	

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—Mar. 14, 1898.						
Canal & Claiborne RR.....1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR.....1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
Crescent City RR.....Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	72½	.....
New Orleans City RR.....1st mtg. 6s.	416,500	399,000	1903	J. & D.	104	110
N. Or.'s City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	108	.....
Orleans Railroad Co.....Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	91½	99
St. Charles St. RR. Co.....1st mtg. 6s.	300,000	75,000	1906	J. & D.	103	.....
†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
\$90,000 outstanding.						

†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.

†\$90,000 outstanding.

New York.

Date of Quotation—Mar. 21, 1898.

Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	
Atlantic Ave. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	108	109½
Atlantic Ave. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	
Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	108
Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1921		116	
Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905		105	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	115	118½
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	116
Brooklyn Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	90
Brooklyn Heights RR. 1st mtg. 5s.	250,000	50,000	1941	A. & O.	104	
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	107	108
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	1,500,000	2,750,000	1941	M. & N.		80
Brooklyn Rapid Transit. 1st mtg. 5s.	7,000,000	5,181,000	1945		94	
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900		105	108
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crostown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	101	105
3d Dock, E. Bd'y & Bat'y R. gen. mtg. g. 6s.	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. scrip 5%	1,100,000	1,100,000	1914	F. & A.	110	*101
Eight Av. RR. Co. Cert. Indeb. 6%	1,000,000	1,000,000	1914	F. & A.	100	
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	118
42d St., Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1937	F. & A.	109½	
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. 1st mtg. 5s.	300,000	300,000	1909	J. & J.	101	105
Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. g. 6s.	350,000	350,000	1919		102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125
Twenty-third Street Ry. 1st mtg. 6s.			1909	J. & J.		
Twenty-third Street Ry. Deben. 5s.	150,000	150,000	1906	J. & J.	103	104
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105

†\$1,035,000 in escrow to retire gen. mtg. bonds.

†\$4,850,000 in escrow to retire maturing obligations.

†\$552,000 in escrow to retire 1st and 2d mtg. bonds.

†In treasury, \$80,000.

†Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Mar. 21, 1898.

Montreal St. Ry. 1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	</
------------------------------------	-----------	---------	------	---------	----

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Mar. 21, 1898						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1908	M. & N.	101	108
Lindell Ry. Co. 1st mtg. 6s.	1,500,000	1,500,000	1911	F. & A.	107½	107½
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co. 1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. 1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry. Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry. 1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	112½	113½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$800,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. ods.						
San Francisco Cal.						
Date of Quotation—Mar. 18, 1898.						
California St. Cable RR. 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	....
Geary St. Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	102	....
Market St. Cable Ry. Co. 1st mtg. 6s.	8,000,000	3,000,000	1918	J. & J.	128	129½
Metropolitan Ry. Co. 1st mtg.	200,000	.....	.....	.....	.....	.....
Omni-bus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
Park & Cliff House RR. 1st mtg. 6s.	850,000	350,000	1912	J. & J.	109	109½
Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
Sutter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Mar. 21, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Mar. 21, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	103	110
Citizens' St. R. (Ind. polis) 1st cons. mtg. 5s.	4,000,000	8,000,000	1933	M. & N.	70	75
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102	103½
Crosst'n St. Ry. (Colu's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	95	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	98	97
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	98	97
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	113	113½
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	92	94
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	.....	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	118	.....
Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	.....	108½
Rochester (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	*95	99
St. Paul City Ry. Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. Ry. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						
*With interest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Mar. 21, 1898						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	1922	Quar.	154	....
General Electric Co. gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	101	....
Pittsburg, Pa.						
Date of Quotation—Mar. 21, 1898						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1918	A. & O.	....	....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	....	M. & S.	....	....
Miscellaneous.—(Mar. 21, 1898)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	....	111½	....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,166,000	1933	....	115	....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	1923	F. & A.	103	....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1906	A. & O.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1921	Q'ry.	....	....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	....	....	75	90
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	....	....	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Mar. 21, 1898						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 7s.	.....	.....	....	....	108	....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	108½	....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	....	....	....	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Mar. 21, 1898						
American Electric Heating Co. 5s.	500,000	500,000	....	....	15	19
Armington & Sims Eng. Co. 10s.	.....	.....	1942	J. & J.	95	100
Barney & Smith Car Co. 10s.	.....	.....	1904	M. & S.	....	....
Carborundum Mfg. Co. 5s.	11,000	.....	....	....	....	....
Washington Pump Co. 5s.	.....	.....	....	....	....	....
Unlisted	.....	.....	....	....	....	....

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 12c.; casting, 11½c.

The underground trolley service is to be installed on the Eighth Avenue line, New York; the present week.

The Frankford & Southwark Passenger Railway Company, Philadelphia, has declared a dividend of \$3.50, payable April 1.

The capital stock of the Buffalo, Hamburg & Aurora (N. Y.) Electric Railway Company is to be increased from \$200,000 to \$400,000.

It is stated that stockholders of the Bell Telephone Company, at their annual meeting to be held March 29, will not be asked to authorize an increase in the capital stock.

In the New Jersey Legislature on the 21st inst. the Squire bill, authorizing the sale of trolley road franchises to the highest bidder, was passed in the House by a vote of 33 to 19.

There appears likely to be a default in the interest on the Louisville Railway common stock on April 1. The directory is divided on the matter but the leading members are said to be strongly in favor of it.

The American Bell Telephone Company has declared its regular quarterly dividend of \$3 per share, payable April 15. The transfer books close for the annual meeting on March 24 and reopen March 30. The books will be closed for dividend March 31 and reopened April 15.

The Cincinnati Street Railway Company has decided upon a further issue of new stock to the amount of \$650,000. After this new issue there will still remain of the authorized capital of \$1,800,000 to be issued \$944,000. At the meeting of the directors on the 15th the usual quarterly dividend of 1½ per cent. was declared.

The Edison Electric Illuminating Company of New York reports for February: Gross earnings, \$256,880; expenses and taxes, \$122,307; net earnings, \$134,573; surplus for dividends, \$89,998. For the same time in 1897 the gross earnings were \$212,803; expenses and taxes, \$94,796; net earnings, \$118,007; surplus for dividends, \$78,932.

The bill granting franchises to street railway corporations which has passed the New Jersey House limits the time for which corporations may use or occupy any public street or highway under any consent, permission or franchise hereafter granted. It limits franchises to 25 years. It is not certain that the bill will get through the Senate.

In a decision just reached by the Massachusetts Railroad Commissioners the Holyoke Street Railway Company is authorized to issue \$100,000 additional stock to capitalize the floating debt incurred by construction. This makes the total capital of the company \$500,000. The Commissioners have fixed the market value of the new issue at \$125 a share.

The announcement has been made that in case the Manhattan Railway Company declines to accept the terms offered by the Rapid Transit Commissioners as a means of increasing speedy transit facilities in New York City, two syndicates have offered to take the matter in hand under the modified terms of the bond, and go to work promptly on the underground or tunnel system.

The Louisville "Commercial" states that "the Louisville holders of the preferred and common stock of the New Orleans Traction Company are placing their stock in the pool very rapidly. There are 33,000 shares of the stock held in Louisville, and the stockholders' committee, composed of George W. Norton, John Russell and Col. St. John Boyle, will be satisfied if two-thirds of this amount comes into the agreement."

It is stated that a commercial company has been organized in New York under the name of the Russian-American Trading Company, with a capital of \$5,000,000; sample rooms are to be established in St. Petersburg, Moscow, Odessa, Riga, Warsaw, Astrakhan and various other parts of European and Siberian Russia. German trade papers are saying that it is the object of this company to secure the control of the Russian markets for machinery, and to secure concessions for the erection of electric light plants, etc.

A mortgage from the Rochester Gas & Electric Company to the Rochester Trust & Safe Deposit Company was recorded a few days ago in the county clerk's office at Rochester, N. Y. The amount of the mortgage is \$300,000, and it is given to fund the floating debt of the company and for other corporate purposes. The mortgage covers all franchises, real estate, gas and electric plants, machinery, apparatus, wires, poles and mains, as well as a number of shares of capital stock in the Brush Electric Light Company.

The annual report of the Electric Storage Battery Company of Philadelphia for the year ended December 31 last is most encouraging for stockholders. Net earnings after the payment of fixed charges amounted to nearly \$322,000. Sales in 1897 aggregated more than \$1,000,000, and were \$455,000 in excess of the sales in 1896, an increase of nearly 80 per cent. Net profits for the year amounted to \$340,000, an increase over 1896 of more than \$190,000, or about 130 per cent. After charging off for depreciation, etc., about \$65,000, the company shows a net surplus for the year 1897 of about \$258,000.

The Asbury Park & Belmar trolley road, sold by order of the U. S. Court, has been purchased by Col. B. M. Harvey of Asbury Park and Acton C. Hartshorne of Freehold, N. J., for \$53,000. The sale was the culmination of several years of litigation. It is generally understood that the sale was in the interest of the Atlantic Coast Company. It is probable that the Atlantic Company will operate a trolley road all the way to Belmar, making a continuous trolley road from Belford on the Bay Shore through Red Bank and all the Monmouth resorts except Spring Lake and Sea Girt.

The lease of the Second Avenue Railroad Company to the Metropolitan Street Railway Company, both of New York, was filed with the Secretary of State at Albany on the 19th inst. The terms of the lease are that the Metropolitan Street Railway Company shall control the lines of the Second Avenue Railroad Company during the unexpired term of the company's charter in consideration of the payment to it of an annual rental of 8 per cent. on the par value of its capital stock for the three years commencing March 1, 1898, and 9 per cent. thereon yearly for the remainder of the term of the lease.

The North & South street railway bill has been reintroduced in the municipal assembly at St. Louis, and is now backed by an organized company. The name of the new applicant for the sweeping street franchise is the Central Traction Company of St. Louis, capitalized at \$100,000. The incorporators are Finis E. Marshall, L. B. Tebbetts and John H. Blessing, of St. Louis; B. M. Snyder, of Kansas City; Jules S. Bache and H. Staples Potter, of Boston. The new bill differs in several respects from the old one which was vetoed by Mayor Ziegenheim after it passed both houses. Among the differences is an increase of the compensation the city is to receive from \$750,000 to \$1,000,000.

The Edison Jr. Incandescent Lamp Company has issued a circular calling for subscriptions to its stock. The company is incorporated under the laws of West Virginia, with a capital stock of \$1,500,000, with shares at the par value of \$100 each, of which \$500,000 is to be non-cumulative preferred stock. Of the preferred stock \$250,000 is to be retained in the company's treasury for future use, and \$250,000 is offered for subscription at par and a bonus of 20 per cent. in the common stock. The circular states that the business of the company secured during the last few months will pay good dividends on the stock now offered for subscription. The money raised by the sale of the stock is to be used as follows: \$50,000 for the expansion of business, and \$200,000 for construction, equipment and operation of factories.

ELECTRICITY.

Vol. XIV.

NEW YORK, MARCH 30, 1898.

No. 12.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4021 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES, - - - - -	\$2.50
IN CLUBS OF FIVE OR MORE, - - - - -	2.00
FOREIGN COUNTRIES, - - - - -	4.50
SINGLE COPIES, - - - - -	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements, - - -	vi
Classified List of Advertisements, - - -	viii
Editorial Notes, - - - - -	177-178
The Telectroscope.	
Future Fields for Electricity.	
The Holland Submarine Boat.	
Under the Searchlight, - - - - -	178
Death of Nelson W. Perry, - - - - -	179
The Modern Financier Wants to Unload on New Orleans Next, - - - - -	179
The Municipal Improvement Association's Proposed Ordinance.	
Insulation and Conduction. By Reginald A. Fessenden, - - - - -	182
The International Ohm, - - - - -	183
A Novel High Tension Series Enclosed Arc System. By J. H. Hallberg, E. E., - - - - -	184
American Institute of Electrical Engineers, - - - - -	185
The Western Telephone Construction Co., - - - - -	185
The New York Electrical Society, - - - - -	185
Legal Notes, - - - - -	186
A Patent Office Bill, - - - - -	186
The News, - - - - -	186
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Commercial Paragraphs, - - - - -	187
Incorporations, - - - - -	188
Electrical Patent Record, - - - - -	188
Telephone and Telegraph, - - - - -	188
Electrical Securities—Stocks, Bonds, Etc., - - - - -	189
Notes for Investors, - - - - -	192

EDITORIAL NOTES.

The Telectroscope. Shortly after the telephone made its appearance and was found to be a commercial necessity, numerous inventors turned their attention to devising some means, through the medium of electricity, whereby a scene or portrait could be reproduced at a distance. Several methods were from time to time suggested in which selenium invariably played an important part, owing to the peculiar quality which this substance possesses of varying its electrical resistance according to the intensity of light thrown upon it. In one rather ingenious but crude method suggested, the transmitting and receiving apparatus consisted of two selenium plates in circuit, divided up into minute squares, each of the latter being connected by a separate wire to the corresponding square upon the second plate. It was intended by such an arrangement to reproduce on the receiving plate by electricity, and through the medium of the connecting wires, any image which might be reflected or thrown on the transmitter. Although theoretically such an apparatus should accomplish what was expected of it, provided the squares were minute enough, as will readily be seen, it necessitated the use of an immense number of separate conductors, the difficulty and cost of sorting and distributing them being considered insurmountable.

Herr Szczepanik, an Austrian Pole, has recently devised an instrument which he calls a fernseher or telectroscope, and which is said to do away with many of the objectionable features previously mentioned. His apparatus, which allows of pictures being reproduced over almost any distance, although far less complicated than any system previously devised is necessarily more or less intricate. Herr Szczepanik makes use of four mirrors coated with an opaque substance, two located at the transmitting end of the line and two at the receiving end. On the coating of two of these mirrors numerous parallel lines are drawn by means of a knife or needle, all those on one of the mirrors being at right angles to those on the other, thus exposing a large number of narrow linear strips of reflecting surfaces. This is to allow of only a single line of the object under observation being exposed to the reflective influence of the mirror. The first mirror in which the object is reflected is pivoted and constantly made to oscillate by means of an electro-magnet. Thus the lines of the scene or picture which is being transmitted are continually changing. Each of these single line reflections is broken up into a series of points by means of the second oscillating mirror, which is located at an angle to the first. Thus, owing to the fact that two lines intersect each other in a point, only a single point of the reflecting line of the first

mirror will appear in the second, and therefore the ray corresponding to that point alone will be reflected from the second mirror.

This ray of light, which corresponds to a given point of the image which is being transmitted, is made to generate a more or less intense current through the medium of a selenium cell. A common form of cell consists of a number of brass disks mounted in a cylindrical column with intervening sheets of mica as an insulating material. The alternate brass disks are electrically connected to form one electrode, the remaining to form the other, the whole being securely clamped together and covered with selenium while hot. As previously stated, the peculiar property of selenium is that its ohmic resistance varies with the intensity of the light to which it is exposed, the resistance being usually about twice as great in the dark as in the daylight. Thus when a cell of the above nature is connected by means of suitable conductors to the receiver, the light rays are converted into electrical impulses of greater or less intensity, which are again reconverted into light rays at the receiving end by means of an electro-magnet. This is accomplished by the magnet moving a prism located in front of a strong white light, the latter naturally being broken up into the seven colors of the spectrum. As the prism is made to move through the medium of the electro-magnet, it will revolve just far enough to bring the required color into view. The color would now be reflected in one of the two mirrors, which are made to oscillate synchronously with those on the transmitter. In this way each point of the picture in its natural color is reproduced by the two receiving mirrors and reflected upon a screen. As the separate points follow one another with great rapidity, the observer, so it is claimed, will take in the impression of the entire picture.

By constantly reproducing the effect the picture may be made to last as long as desired. It is said to be no more difficult to reproduce a moving picture than a still one, for according to Herr Szczepanik it is the actual picture which is reproduced and not a mere record as in the case of the cinematograph. The inventor moreover claims that there is no limit to the distance at which the apparatus may be successfully operated.

It is claimed by those who have had an opportunity of examining Herr Szczepanik's apparatus, and watched the transmission of an image, that the colors in the reproduced picture are not always clear and the objects reproduced do not remain steady but are constantly vibrating as in the case of cinematographic images. This defect will, however, undoubtedly be remedied at some future day by the inventor, who is constantly seeking to improve and simplify his apparatus. If Herr Szczepanik has succeeded in accomplishing what is claimed, he has solved a problem upon which inventors have been at work for

years, and has given to the world an invaluable invention. The usages to which this apparatus could be applied are both numerous and interesting. In a commercial way it would enable of business being transacted as safely and conveniently at a distance as over a counter, owing to the possibility of identifying a person, or even if necessary watching him attach his signature to an important document. In the event of war such instruments could be located at various points along a coast, and would enable a person situated miles away to detect the advance of a hostile fleet. Battlefields during action, foreign scenes or an eclipse of the sun might be observed. In fact, there are hundreds of uses to which the teleoscope could be adapted if found to work properly. As we understand, Herr Szczepanik intends to exhibit his invention at the Paris Exhibition of 1900, so that in all probability any minor defects in the apparatus which may now be apparent will undoubtedly be remedied during the next two years.

* * *

Future Fields for Electricity.

Of late years there would seem to be a growing demand for electrical machinery among the countries of Central and South America. About eight years ago Mexico suddenly awakened to the fact that the large water powers in that country were going to waste when they could be advantageously utilized for generating electricity for various commercial purposes. An electric plant was accordingly installed and proved so successful that others immediately followed. Some idea can be formed of the rapid strides electricity has made since then in Mexico, when it is stated that during the last year the United States exported electrical machinery and apparatus to that country amounting to \$284,714, and during the present year will in all probability export several times that amount, if the rumor is true that the City of Mexico is shortly to have all its street railways operated by electricity at a cost of \$3,000,000. This advance has been steadily made since 1890 in spite of the peculiar character of the people, who have the reputation of ever making haste slowly. As Mexico abounds in sources of water power and is practically destitute of fuel, the development along this line was inevitable.

Argentina is also beginning to employ electricity for various purposes. Owing to the facilities that country possesses for procuring coal economically from England, steam is mostly utilized for generating electric power. Although electricity has been but recently adopted in that republic, the exports last year of electrical apparatus from the United States to Argentina amounted to \$157,561.

There also appears to be a growing demand for electrical machinery in Brazil, but that country, not being so well situated as Argentina in regard to the procuring of cheap fuel, the inhabitants are making some use of the limited water power available. Recently the Minas Railway Company was incorporated at Albany, N. Y., with a capital of \$500,000, to construct and operate an electric railroad in the city of Minas. Thus it will be seen that Brazil is awaking to the necessity of adopting modern methods. During the last year the United States sold Brazil \$110,460 worth of electrical apparatus, a considerable amount when it is recalled that but a very few years have elapsed since the first generator was started running in that tropical region.

Lima in Peru has recently installed an electric lighting plant, and Chili, Colombia and other South American countries are also beginning to appreciate the advantages of electricity, as can be seen from the fact that \$66,084 worth of machinery of the above nature entered the latter country during 1897.

The next new source of demand will unquestionably be Africa. Certain sections of that continent, notably Portuguese Africa and the Cape Colony, have made rapid strides of late in industrial enterprises, immense quantities of iron pipe and other

products being shipped there annually from this country.

Gold mining, which is carried on on an extensive scale in certain portions of South Africa, should in the near future create a considerably increased demand for electrical machinery now that several electro-metallurgical processes have proven successful in the recovery of that precious metal. It is therefore only reasonable to suppose that electricity will before long be extensively adopted owing to its economy as a motive power either for pumping water, propelling street cars or in gold mining.

* * *

The Holland Submarine Boat.

For probably the last quarter of a century serious efforts have been made by inventors, especially in England, France and in this country, to perfect a boat that could be operated successfully under water. One of the great difficulties which had to be overcome was in finding a motive power wherewith to operate the machinery while the vessel was submerged. In most of the early attempts this proved to be one of the main difficulties, and it was not until electricity came into general commercial use that the solution was found.

Mr. John P. Holland, who has been working on the submarine boat problem since 1877, has recently launched a craft of the above nature which, so far, if we except an occasional slight derangement of the machinery, seems to have proven eminently successful. This boat, which by the way is the sixth that the inventor has built, is cigar-shaped in form, 53 feet in length by 10 feet 3 inches in width. Her frame is of steel, to which plates of similar metal about one-half inch in thickness are securely riveted. A small conning tower, two feet in diameter, rises from the middle of what might be termed the deck, and it is through this opening that access is had to the interior of the vessel. When running only partly submerged, the pilot can from the conning tower obtain a view of the surroundings. Just before diving this opening is hermetically closed.

The boat may be submerged either by admitting water to a number of tanks, or when properly ballasted may be made to dive by manipulating the horizontal rudder with which she is provided. This horizontal rudder also enables the vessel to be kept at any desired depth below the surface. One of the inventor's aims in the construction of this craft was to allow of her being run either entirely on the surface of the water, in which condition she is expected to make 16 knots an hour, or partly submerged, with nothing but the conning tower visible, or again entirely submerged. In the latter case her speed would be materially reduced, probably not exceeding eight to nine knots an hour.

The necessary motive power for this submarine boat is obtained by means of a 50 HP. gasoline engine and storage batteries, the latter weighing 21 tons, located in the bottom of the vessel and serving as ballast. When running on the surface the gasoline engine is usually employed to drive the single screw, but when about to dive the engine is disconnected from the propeller shaft and the motor substituted. The boat is illuminated by means of electricity, and is also provided throughout with electric bells for communicating purposes. When the vessel has been running submerged, and it is desired to come to the surface, compressed air is admitted to the tanks containing the water, and the latter being expelled the boat rises to the surface. The crew are provided with fresh air from these same tanks, which contain sufficient to last them for nine or ten hours. In the event, however, through any mishap of the air living out, a float is provided which could be attached to an air tube and sent to the surface, and by this means air could be drawn into the interior of the vessel.

One of Mr. Holland's principal claims is that his submarine boat would prove invaluable in time of war and could destroy single-handed a whole fleet.

From the successful tests which have recently been made with this vessel in Staten Island Sound, it would seem as though Mr. Holland's claims were well founded. In the several trials this submarine boat underwent, it was proven beyond doubt that she could be made to dive or sink at will. The only trouble noticeable appeared to be with the machinery which, either owing to its complexity or delicacy, was frequently getting out of order. This no doubt was in part due to the fact of its being new and not in good working condition.

As a motive power for submarine boats electricity as derived from the storage battery would seem to be everything that could be desired, as it operates the motor without consuming oxygen, which is greatly to be desired where air is comparatively scarce.

Under the Searchlight.

Notes and Comments on Various Topics.

THE New York *Commercial* says: "Some General Electric stock has gone astray. It is in a freight car, and was lost somewhere between Schenectady and Worcester, where the General Electric Company is setting up new machinery for the Consolidated Street Railway Company. The stock is lost, car and all. If any one has seen it wandering through the country he will confer a favor on the General Electric Company by sending a postal card to the Edison building, Broad street, stating where it can be found." This is by no means the first batch of stock belonging to the General Electric Company that has gone astray.

* * *

THE Philadelphia *Record* states that a four-inch circular saw for the amputation of limbs is being installed at the Emergency Hospital at Boston. An electric motor will furnish the power to run the device. The saw will be mounted on a flexible shaft like that which a dentist uses, only larger. The bearings, in which runs the saw arbor, are attached to a handle by which the surgeon is able to direct the saw at any angle. Dr. Galvin and his assistants will be able to save considerable time by the use of this appliance. Not only does the saw cut much faster than a hand tool, but the heat of its rapid cutting sears the flesh and blood vessels and the healing processes of nature are advanced to a stage which by the old method is reached only after an hour or two.

* * *

Directors of the General Electric Company intimate that the matter of General Electric deferred preferred stock dividends and capital impairment is now under consideration, and they express the opinion that these matters will be settled before very long. A prominent director says: "The company is now doing exceedingly well and I think the stock is now a purchase."—*Boston News Bureau*.

It is just such stuff as this that has been appearing in various papers almost word for word during the past two years. The General Electric Company must certainly believe in the saying that there is a fool born every minute.

* * *

A UNIQUE lawsuit is about to be brought against the Nassau Electric Railroad of Brooklyn. It is claimed that the above company is directly responsible for \$500 worth of damage done to furniture and other household effects in a dwelling located along the line of the road. The complainant, who by the way is a woman, states that on the day named in the complaint one of the trolley wires broke and the motorman gathered it up and wound it around a lamp-post directly in front of her house. She claims that the electric current was communicated from the trolley wire to the lamp-post, thence to the gas-pipes which entered her house, and up through the walls until it met a lead water pipe. The current expended its full force on the lead pipe, melting it so badly that the water escaped in large

quantities. She says that the floors and ceilings and all the furniture in two rooms were practically destroyed by the flood of water thus let loose.

* * *

ACCORDING to the London *Electrical Engineer*, a new form of footwear is being extensively advertised in that city, known as the "Galvanic genuine electric boots and shoes." The company exploiting this new form of footwear has gotten out a pamphlet to which our English contemporary refers as follows: "The logic in this little book is worthy of notice. Thus, we learn that 'motion is philosophically regarded as the first attribute of life. An electric current is electricity in motion, and it is an established fact that continuous currents of electricity actuate the circulation of blood, and are, indeed, the very propelling power which stimulates it in its onward course: therefore 'the blood is the life,' but electricity is the life of the blood.' Coming down to the feet, we learn that 'the sole of the foot is one of the most delicate parts of the human system, owing to the quantity of sensitive nerves with which it is supplied: therefore, as the electric apparatus acts directly on these nerves, it cannot fail to have a comforting and beneficial effect. Undoubtedly voltaic electricity is the best means of exercising electric influence on the human system, no shocks being felt. The reparative action of 'continuous current' produces effects analogous to those of the natural currents in the body whilst the latter is in a state of rest, whereas the effect of the intermittent current (shocks) on the system is analogous to those produced by the discharges of animal electricity, owing to muscular exertion, and thus tends to exhaustion of vital force.' Coming to the construction of the boot, we find that one of the Pulvermacher Company's 'band chain' batteries is inserted in the felt inner sole. The cells consist of equal lengths of zinc and gilt copper wire wound on a flexible flat band and separated from each other by an insulated thread. The moisture from the feet does the rest, and the mild invigorating currents for which the Harness electropathic belts were noted are produced. The mechanical construction of this chain is not illustrated, but, like the Harness belt cells, if a current is produced and applied continuously, sores are also produced, which are not wanted on the soles of the feet. No connection between zinc and copper and good faith on the part of the wearer are the great desiderata to make these boots both harmless and useful, but the faith might be exercised on a pair of ordinary boots and the saving in first cost devoted to charity."

DEATH OF NELSON W. PERRY.

We are pained to have to announce the untimely death of Nelson W. Perry, which occurred at 7 o'clock on Sunday evening at his residence in Brooklyn. On Saturday night Mr. Perry, with his usual love for research, was experimenting in his laboratory. During the course of his work it was necessary to turn out the gas, leaving the room in total darkness. Mr. Perry becoming thirsty reached for a glass of water standing on a table, but by mistake picked up a glass containing bichloride of potassium which he drank. Immediately recognizing the peculiar taste of the poisonous fluid, he announced the fact to a member of his household, and several physicians were sent for who worked unremittingly over him for some hours. It was believed at one time that he was improving, but on Sunday he grew gradually worse and at the hour mentioned expired.

Mr. Perry was exceedingly well known among the electrical fraternity and was extremely popular. He was born in Columbus, Ohio, in 1853, his father being Judge of the Supreme Court in that State. He received his education at the Phillips Exeter Academy, Harvard University and the School of Mines, Columbia College. At the latter seat of learning he showed remarkable ability, graduating first in his

class in a number of subjects including an advanced course in physics. In 1880 he was appointed to the chair of metallurgy at the University of Cincinnati, and for a number of years thereafter practised his profession of mining engineering. During this period he did considerable research work in chemistry, and evolved a new method for making platinum assays. He also contributed several important papers to various scientific societies.

In 1887 Mr. Perry gave up mining engineering to go into electrical engineering, and for several years thereafter was connected with a number of leading electrical manufacturing companies. In 1891 he became connected with *ELECTRICITY*, first as associate editor, later as editor, holding the latter position until a few months ago. His excellent work in connection with this journal needs no comment. Mr. Perry's ability was well known. He was a member of the American Society of Mechanical Engineers, a member of the New York Electrical Society, a member of the Institute of Mining Engineers, a foreign member of the Deutsche Gesellschaft für Chemie of Berlin, and of the Societe Chimique of Paris. He was also a member of the American Institute of Electrical Engineers, in which society he took a leading part, frequently contributing valuable papers at its meetings.

Mr. Perry was married twice, and leaves a widow and three children to mourn his sad fate. The sudden death which terminates a career so full of promise is to be deeply deplored, and *ELECTRICITY* tenders its sympathy and condolence to the relatives of the dead man.

The remains were taken to Cincinnati for interment on Tuesday evening.

THE MODERN FINANCIER WANTS TO UNLOAD ON NEW ORLEANS NEXT.

A wave of municipal financiering seems to be sweeping over the country and the modern financier has new opportunities without number for "doing" the public and increasing the pile already in his coffers. Is it any wonder that a few people are growing richer every day and the public at large growing poorer?

In Philadelphia some of the modern financiers have recently leased the gas works and formed a company, with a large issue of stocks and bonds, for manipulating the deal. Municipal ownership there is of course not now the thing—at least not until all the money has been made that can be made by the insiders, and then, we suppose, the city will buy the leasing company out and another rake-off will be made by the insiders.

We publish below an interesting and unique document from New Orleans. This is a "peach" in its way, and needs no explanation any further than that all idea of the prices to be paid for various private plants to be purchased by the city is omitted, either intentionally or unintentionally.

In our issue of January 26, 1898, we called our readers' attention to the fact that a large part of the stock and bonds of what is known as the Edison Electric Company of New Orleans, which it is now proposed to unload on the city, was owned by the General Electric Company. According to their 5th Annual Report, issued on January 31, 1897, the above organization controls \$3,871,000 worth of these securities.

In view of the recent arrival at New Orleans of a private car loaded with cash and containing one of the slickest men in the business, we can but imagine that "sugar, if necessary," will be used to push forward the electric part of the scheme. If this sale to New Orleans of the lighting plants could only be accomplished before the annual report of the General Electric Company appears, we presume profits could again be made by marking up the prospective value of New Orleans lighting securities.

This is a funny world, surely, but it is funnier for

the modern financier than for the public. As electrical securities are dead slow on the New York Stock Exchange, it is but natural that a market should be found for them among the various municipalities.

Among the men whose names are suggested by the so-called Improvement Association for the first Board there are undoubtedly a large number who would justly refuse to have anything to do with such a scheme were the matter only placed before them in the proper light:

THE MUNICIPAL IMPROVEMENT ASSOCIATION

Of New Orleans (P. O. Box 1020).

Wm. B. Bloomfield, President.
J. L. Lyons, First Vice-President.
Geo. Lhoté, Second Vice-President.
Hugh McCloskey, Third Vice-President.
Lewis Johnson, Fourth Vice-President.
Herman Meader, Fifth Vice-President.
T. J. Woodward, Sixth Vice-President.
E. F. Kohnke, Seventh Vice-President.
R. B. Jones, Secretary.
Julius Weis, Treasurer.

ORDINANCE TO INSURE MUNICIPAL OWNERSHIP OF PUBLIC WORKS.

EQUAL PRIVILEGES TO ALL. SPECIAL PRIVILEGES TO NONE.

The Duty of the Convention to Grant New Orleans a Board of Public Works.

The Citizens of New Orleans should not Divide their Forces on Separate Bills, but should Concentrate upon One Ordinance to obtain Municipal Control of all Public Works.

NO WASTE AND EXPENDITURES FROM CHANGE OF ADMINISTRATION—TAX REQUIRED NOT TO EXCEED TWO AND ONE HALF MILLS—REDEMPTION OF ALL BONDS GUARANTEED BY 1950.

By this Ordinance the Public Schools of New Orleans will receive about \$75,000 additional to their present fund. Employment will be given to thousands of laborers. Every Citizen and Member of the Convention should oppose all bills that do not provide for the Municipal Acquisition of the Waterworks, Sewerage and Other Public Works.

To the People of the City of New Orleans:

It is an unpleasant fact to state that the city of New Orleans has been for the past twenty years one of the least progressive cities of the United States.

It has declined in population from sixth place to twelfth.

The city of New Orleans lacks that progressive character which attracts population and manufactures.

A mighty effort must be made to place our city in the front rank of American cities.

About a year ago "The Municipal Improvement Association, of New Orleans," was formed for the purpose of devising plans for the benefit of the city.

They have prepared an ordinance, to be brought before the Constitutional Convention, providing for a Board of Public Works.

It was published expressly for every citizen to read, so that it could be subjected to criticism.

The object of the ordinance is to enable the city to acquire and operate its own public works, which would be a benefit to the city itself, and, at the same time, give employment to thousands of men—its citizens—in building up the various systems of public works.

The proposed Board of Public Works is not a private corporation, formed to make a profit out of the city, but is a part of the city government itself.

Nothing is taken away from the city. Public works which should be owned by the municipality are now in the hands of private corporations.

If the ordinance becomes a law, the city government will perform about the same functions in the future as now, with this exception: instead of col-

lecting from the taxpayers more than two hundred thousand dollars for street lighting, and paying same to private corporations, the amount will be placed under control of the Board of Public Works, to be administered for account of the city, with the ultimate object of acquiring the lighting plant.

The same thing will be done as to other corporations. Between the two, is not the latter the better plan?

In regard to the organization of the Board, a membership of one hundred was suggested, with the view of dividing them into committees having charge of the various works and systems; all of these sub-committees, however, to be directly under the supervision and control of the entire one hundred members.

The first Board shall be composed of the following named persons:

Wm. B. Bloomfield, Hugh McCloskey, Lewis Johnson, George Lhote, J. C. Murphy, Peter S. Lawton, E. F. Kohnke, W. A. Gordon, S. F. Heaslip, Herman Meader, Jno. B. Myers, P. W. Mulqueeny, W. H. Dwyer, Jas. D. Hill, Maurice Stern, W. E. Lawrence, W. H. Byrnes, John A. Davilla, T. J. Stanton, Robt. B. Jones, Julius Weis, A. A. Maginnis, Chas. Godcheaux, J. W. Hearn, Geo. W. Young, R. W. Wilmot, Frank R. Johnson, J. B. Sinnott, John Everet, W. H. Douglas, Thomas White, S. Locke Breaux, F. Reusch, Jr., D. D. Colcock, Eugene May, Thomas Sloo, W. J. Montgomery, G. G. Norris, Frank Dameron, Geo. H. Dunbar, Thos. J. Woodward, Geo. Soule, Paul Gelpi, Jos. Garcia, Jno. D. Moulin, Walter A. Taylor, B. M. King, R. H. Lea, Wm. Atkinson, B. P. Sullivan, James H. Dillard, Paul Capdevielle, B. P. Moss, Peter Elizardi, P. McGrath, Ed. Cunningham, John Lynch, N. J. Long, D. B. Morey, Sam Geoghegan, Dennis Sheen, W. A. Kernaghan, H. Buddig, J. B. Collins, Jno. T. Gibbons, H. L. Franz, Jno. Houlgrave, M. J. Sanders, Jas. Thibaut, Hugh Flynn, Geo. K. Pratt, W. G. Vincent, Felix Couturie, John Henderson, J. F. Markey, Chas. Feahney, E. F. Dyer, A. R. Blakely, Chas. Dittman, Denis Lanau, J. Watts Kearney, Otto Thoman, Henry Carstens, Henry Thoele, Frank W. Young, Frank Barker, Thos. M. Gilmore, R. H. Keen, F. R. Cogswell, Gustave Pitot, A. Darcantel, Julius Koch, W. W. Carre, N. Burg, J. B. Cefalu, P. Powers, Wm. M. Baker, Eugene F. Buhler.

It would take the time and attention of a committee of ten or more members to administer the water works; as large a committee would be required by the drainage system, and so on with each separate and distinct work; but as all of these would co-operate under the supervision of the whole Board of Public Works, the present unseemly and injurious scramble of every Board for itself and a tendency to grab all for its special object, ignoring and combating other equally important and necessary adjuncts to the advancement of the city, would be checked and properly regulated by the whole Board with an eye single to the general good. A Board controlling millions of dollars of the people's money should have a large membership of our citizens.

This large membership lessens the chances of the Board being corrupted.

It is much easier to influence and corrupt a small number than it is to corrupt the majority of an hundred.

Political control of the Board is minimized, because no one holding an office of profit, either State, parish or municipal, can become or remain a member.

In proposing a Board of this character, invested, as it is, with such large powers, the Municipal Improvement Association was impressed with the great responsibility which it assumed.

The question determined was that the Board of Public Works should be run upon a business basis, and removed as far as possible from political influence.

It was, therefore, thought best to suggest the names of the one hundred members to compose the first Board of Public Works.

The members have been selected from every class—the merchant, the clerk and the laboring man having their representatives on this Board.

The Board is divided into three classes of thirty-four members each, their terms of service varying from four to twelve years.

Every four years one term expires, thereby retiring thirty-four members, whose places shall be filled by thirty-four men elected by vote of the people at the general election in this city, two from each of the seventeen wards. The bill prohibits the re-election of the thirty-four retiring members.

There are three methods provided in the Bill for removing members of the Board: by a two-thirds vote of members, by suit of twenty taxpayers or a creditor of the Board to the amount of twenty-five thousand dollars.

The ordinance affords no ground for the assertion that the Board is a self-perpetuating body, for, as above explained, thirty-four members are elected, by vote of the citizens, at the general election, every four years.

It has been said that the voice of the people should be heard in selecting the first Board. Theoretically, this is correct. But, practically, if the first Board were left for selection at a general election, the danger is that the ballot-box stuffer would elect the members.

The present Grand Jury has indicted a number of election officers for fraud; and this in spite of an "election system" that is supposed to exclude all possibility of fraudulent voting.

The Board of Public Works is given power to acquire and operate the following public works and systems of the city of New Orleans:

SEWERAGE.

A sewerage system is urgently needed to carry off daily all the fecal matters from 50,000 privy vaults of the city.

The city granted a sewerage franchise to a company, which is now in the hands of a receiver, and the city has instituted suit for the forfeiture of the franchise.

If this private company were to succeed, it is believed that in addition to the issue of bonds necessary to construct the system in the district specified, there would probably be a further issue of two millions of dollars of stock, upon which a dividend of, possibly, 6 per cent. would be declared, thus taxing the citizens one hundred and twenty thousand dollars per year over and above what they would be taxed if the system were owned by the city itself, in which case no profits would have to be paid to stockholders.

The sewerage system contemplated by this private company was to be located, for the present, only in the thickly settled part of the city, where the most income would be produced.

The other parts of the city would possibly remain unsewered for years to come.

WATER WORKS.

The water works, owned by a private corporation, was once owned by the city; but not being controlled by a permanent Board, it was made a political office, carrying with it the disorganizing feature of all political bodies—the dismissal of officers and employees after every election.

The constant change of management, for political reasons, could not but result disastrously.

There is a general complaint as to the quantity, quality and the price of water.

The New Orleans Water Works Company has a capital stock of two millions of dollars, and declares a dividend of one hundred thousand dollars yearly.

LIGHTING.

The city is paying more than two hundred thousand dollars per year for street lighting, about one-eighth of its entire alimony.

A private corporation must make its charges sufficient to declare dividends upon stock watered, possibly, in excess of its actual value.

The drainage plant, now being erected to furnish electric power to run the various pumps of the city can, with small comparative cost, be increased sufficiently to perform all of our street lighting.

If used for drainage purposes alone, the machinery would be idle most of the year.

GARBAGE AND STREET CLEANING.

Garbage and street cleaning should be placed under a Board of Public Works, in order to remove such an important function from the changing administration accompanying political control.

PAVING AND BANQUETTES.

A uniform system of paving and banquettes should be carried on until the entire city has been thoroughly paved. New Orleans has expended from its own treasury more than two million of dollars, within the last few years, for its share of street paving, besides three millions of dollars paid by private citizens as their assessment for streets and banquettes, and the largest part of this alleged "paving" is gravel. The city and the citizens have little to show for this expenditure, aggregating five millions of dollars.

TELEPHONES.

The streets of a city belong to the people, and their monopoly by a fortunate few, under a "telephone franchise," is not impartial government.

The present company charges ninety-six dollars per year for each telephone. The Board of Public Works could furnish a better service for thirty-five dollars.

This discrepancy shows how this corporation has been able to declare a profit of over one million dollars in twelve years. The difference between these two charges is about sixty dollars per year, which is equal to paying a tax of 1 per cent. on six thousand dollars, or a tax of two and one-half mills on twenty-four thousand dollars.

It is this exorbitant rate that denies the use of the telephone to the majority of our citizens.

BELT RAILROAD.

The future must be considered in connection with the matter of a belt railroad. The Mississippi Valley will soon have from fifty to one hundred million population. The increase of commerce therefrom will draw to the city scores of new railroads, all seeking the river front to connect with the shipping.

Should such an important factor in the city's prosperity as a belt system be placed under the control of one railroad, or should it be placed in charge of a Board of Public Works, whose policy will be to offer the same facilities to all roads alike? The first plan would remit the city's interests to a single railroad corporation, which would dictate terms to other roads, to selfishly further its own interests, while the Board of Public Works would advance the city's interests by granting the same rights to all, and special privileges to none. The policy of every railroad would be that of the T. & P., whose ordinance is now pending before the City Council, which provides that other railroads could use its belt system, "if the same did not discriminate against the Texas & Pacific." We may feel assured that all the belt facilities furnished by it would only be sufficient to meet the needs of its own traffic.

The Louisville & Nashville Railroad Company have an application before the Council for a similar grant along the river front below Canal street, which, if granted, would effectually exclude a belt system from that portion of the city.

The City Council should refuse to grant the application of these two roads. Public interests should be served in preference to private interests always.

A belt system under the control of the Board of Public Works would be enlarged to meet the growing needs of this port, and all existing or future roads would have free use of these facilities upon their paying their share of the actual expenses of the road. A different policy will build up other points, like Chalmette and Southport, to the detriment of our property holders and laborers alike; or

worse, cause the railroads which would prefer New Orleans as a terminal to seek instead Galveston, Sabine or Mobile, rather than be harassed by the dictation of a rival road in the use of city water front.

WHARVES.

Fortunes have been made out of the wharf leases, and these fortunes have been made at the expense of the commerce of the city. The wharves and landings should not be administered by private persons for private gain. All tonnage coming to this port should have like facilities at the lowest cost.

SYSTEMS SELF-SUPPORTING.

The systems above enumerated are required by the ordinance to be self-supporting. The charges for the privileges must be sufficient to meet the expenses, so that no system shall be a burden upon the taxpayer who is not using it.

PARKS, PUBLIC SQUARES AND PLACES.

In the hot climate of this latitude cities require breathing places for the people. There should be a large increase in the number of public parks and places in the city, and unless land is shortly acquired for the purpose it will cost millions to obtain these municipal lungs in the near future.

The city of Glasgow has added more than twenty-five squares and parks to its system within the last forty years.

DRAINAGE.

Drainage is so intimately linked with the other public works mentioned that it has been provided for in this ordinance in order to obtain a unified, central administration.

A practical illustration will emphasize the necessity for a central administration of public works.

Under a system of independent boards, suppose the Drainage Commission has finished its work in a certain section of the city and is followed by a Sewerage Commission. There would of course be an undoing of the Drainage Commission's work. Then, probably, the Waterworks Board would follow the Sewerage Commission, and there would necessarily be further destruction of previous work. And a conduit system (even now in course of adoption) might, perhaps, nullify the work of all preceding boards; or the paving of miles of streets might all be undone and the expense multiplied by the drainage and sewerage following immediately on its completion.

Under a Board of Public Works having a central, unified policy or plan, these different works would be economically systematized.

HOW THE PUBLIC WORKS CAN BE CONSTRUCTED AND ACQUIRED BY THE CITY.

It can scarcely be disputed that all of these systems and works should belong to the municipality, and this consummation is assured if this Board of Public Works be created under the constitution. Its chief purpose will be to acquire them, and by the powers given to it in the ordinance it will in time succeed.

It provides a two and one-half mill tax to be voted for by the property taxpayers in 1898, and it further provides for mortgaging and pledging the revenues of the various systems to insure their construction; and the right is given to make leases, which opens the way to contract for the building of every system needed. In each lease there could be embodied the right to purchase the system from the lessee who constructed it for a fixed sum, at a certain date, stipulating that all the rent paid during the term shall be taken as payment on account in the final transfer of the system. This insures municipal ownership in reasonable time.

The money expended now for a service, which goes to the stockholders of private corporations, would, under the proper management by a Board of Public Works, be paid, to create rights in the plant itself, which now remain the private property of the corporations performing the service. We propose to inaugurate under the Board of Public Works a home-stead system, where every dollar paid for a service shall finally inure to the benefit of the citizens paying it, by creating a right in the system itself fur-

nishing the service until the plant becomes the property of New Orleans.

The amounts now paid by the city to contractors and to departments of the city which will be assumed by the Board of Public Works are as follows:

Jefferson City Gas Light Co.....	\$30,105.00
Louisiana Electric Light Co. (estimated).....	180,000.00
New Orleans Waterworks Co.....	94,752.00
Algiers Waterworks & Electric Light Co.....	11,280.00
Great So. Telegraph & Telephone Co.....	8,000.00
Wharves and landings.....	10,000.00
Commissioner Public Works.....	130,311.75
Garbage.....	120,000.00
	\$379,448.75

For running the various drainage stations when completed, and for other purposes.....

60,000.00

\$639,448.75

The ordinance provides that the city of New Orleans shall pay over to the Board of Public Works two-fifths of its estimated revenue, which amounts to about \$640,000, as per above table; this, together with the sums that will be received from the permanent public improvement fund and the public improvement fund will in time enable the city of New Orleans to become the owner of the plants performing the services.

Besides, in the division of the public improvement funds, the ordinance provides an increase of the income to the public schools of over \$100,000 per annum, and no argument is needed to demonstrate the necessity of this addition to the cause of education.

No plan can be suggested to the Convention which undertakes to acquire and do so much for the people based on so small a burden of taxation and municipal expense.

Our city has now an assessed valuation of \$140,000,000. Should the assessment rolls increase, due to the building up and improvement of our city, \$3,500,000 yearly for the next ten years, we estimate that the revenues of the Board of Public Works for that period would approximate the following:

Proceeds from sale first issue of bonds.....	\$3,000,000
In ten years the assessment rolls are estimated to reach the sum of \$175,000,000, when the Board will be authorized to make a further issue of bonds of.....	2,000,000
The 20 per cent., known as the "Reserve" over and above "The Estimate of Revenues" of the city of New Orleans, now expended by the city for improvements, is to be turned over to the Board. The fund is now estimated to be.....	\$400,000
Assuming that of this amount there is collected only.....	300,000
One-fourth to the School Board, say.....	75,000
Leaves for the Board of Public Works.....	\$225,000

In ten years say a net revenue of.....	\$2,580,000
The estimated amount which the School Board would receive in these ten years from this source would be.....	\$853,500
After paying interest on the Board of Public Works bonds from the two and one-half mill tax there would be a surplus of \$682,500, one-half of which goes to the Board of Public Works, say.....	341,250
And one-half to the School Board, say.....	841,250

Total amount paid by Board of Public Works to school fund in ten years..	\$1,194,750
Total amount of cash at disposal of Board of Public Works in ten years.....	\$10,901,250

In addition to this estimated income of about eleven million dollars, there is a further sum turned over to Board of Public Works of two-fifths of estimated receipts of the city, as explained above, which on present assessment yields about six hundred and forty thousand dollars yearly.

All of the above revenue would be produced by a small tax of two and one-half mills. The principal resources of the Board of Public Works would not be alone the above amount, for the Board is authorized to mortgage and pledge the revenues of the various systems, so that each system would only require a small amount of cash to be commenced, and the balance required to finish the systems would arise from mortgaging and pledging the revenues.

The Permanent Public Improvement Fund, now amounting to two hundred thousand dollars per year, is applied to pay obligations of the Drainage Board, which Board calculates to issue bonds to the amount of one million five hundred thousand dollars. If the Board of Public Works takes up this amount of bonds of the Drainage Board, it will reduce the above amount, in which case the Permanent Public Improvement Fund is thereafter to be turned over to the Board of Public Works, which would replace within a few years the million and a half dollars used to redeem the bonds of the Drainage Commission.

The claim of every system referred to in the ordinance is considered by some certain class of citizens as paramount. This is the best argument to prove that each and every one demands immediate consideration and active inauguration. Any efforts to obtain only one or two of them is a serious blow to the general interests of the community. No drainage and paving systems alone should be permitted to monopolize all the public funds to the exclusion of sewerage and the control of the waterworks. Each and all are important, and should be undertaken by the Board of Public Works. The acquisition of all the systems finally is only a question of the Board's competency and management, as the above exhibit of income provides the means. Let the Board have the opportunity to acquire those things needed by the city to advance its health, comfort and prosperity.

Ordinances with but a single object are likely to be introduced by men with good intentions, and their projects will be supported by politicians, corporations, and such like, on the outside of the Convention, who will wish to divert all interests to one subject, while they hope to make money out of extravagant city contracts.

Every citizen and every member of the Convention is warned against all such schemes, whose final and direct object is to prevent municipal ownership.

Municipalities in America have sold franchises and rights, mortgaging future generations, which, if administered prudently to-day under municipal control, would yield revenues sufficient to defray the expenses of their government. Glasgow to-day is administered without taxation.

Indirect taxation paid to monopolies created by State law or city ordinance exceeds the direct taxation paid by the people.

It may be objected that the ordinance is too long, containing too much detail to be embodied in the constitution. This point is not well taken when it is considered that the matters herein dealt with are vital to a healthy municipal life; that the city of New Orleans comprises one-fourth of the entire State population; that in no country, save France, is a single municipality so linked with the destinies of the entire State as in Louisiana.

The plan we propose is necessary, and is entitled to all the space required in the constitution of the State to make it effectual; and this seems more reasonable, as the Board of Public Works should be free from political domination and political vicissitudes.

By reason of the "fever scare" of 1897, this city has become the focus of observation for all other parts of this State, for the Mississippi Valley, and for such parts of the United States as may be affected by the introduction of yellow fever, and their judgment as to how they shall deal with us is held in suspense as they watch how we are prepared to deal with ourselves. Self-preservation forbids the adoption of a policy of "drifting on the tide of time," and demands that we should resolve to save ourselves. "God helps them that help themselves," and the necessity for such works as the ordinance creating the Board of Public Works suggests, makes it the imperative duty of the present Convention to put this city in the way of procuring the same at the lowest cost, in the quickest time, and with security for their best administration.

THE MUNICIPAL IMPROVEMENT ASSOCIATION OF NEW ORLEANS, LA.

INSULATION AND CONDUCTION.*

BY REGINALD A. FESSENDEN.

A thing insulates because it is possessed of two distinct properties—first, the ability to stand the mechanical and electrical stresses due to the voltages used, and secondly, because it is such a poor conductor that but a negligibly small current can flow through it and leak away. In other words, it will neither allow the current to break through it, nor to steal through it. The first property is called by Maxwell the "dielectric strength" of the insulator, the other property is called the ohmic resistance. The two together form its insulating power.

In the two great branches of electrical work, the requirements for an insulator are widely different. For apparatus used for the transmission of intelligence as a rule low voltages are used, and so dielectric strength is of relatively small importance, but the currents used are small, the circuits long, and material of high ohmic resistance is needed. For apparatus designed for the generation and transmission of electric energy, on the other hand, where the voltages are high and the currents large, dielectric strength is the main thing desired, and the leakage of a small amount of current is not objectionable. Consequently the two branches of the profession have come to use the word "insulation" in quite different senses, the former and older as meaning something having high ohmic resistance, and the latter branch using it with reference chiefly to material having great dielectric strength.

Confusion sometimes occurs through this double meaning, and the writer himself has been taken to task by a European engineer for stating that pure water was approximately as good an insulator as rubber, the critic having reference, as was apparent, to its ohmic resistance, whilst the original note was principally concerned with its dielectric strength. It is therefore considered best to define the sense in which the word is used, in spite of the fact that attention has previously been called to the distinction to be made between these two properties, notably and very lucidly by Mr. Steinmetz in this Institute's Proceedings, Vol. IX, p. 815.

Before entering upon the discussion of the various purposes for which insulation is used, and of the substances best suited to each case, it may be as well to give a brief account of the manner in which the current passes through materials.

1. *By actual convection.*—That is, by particles of the insulator, or of foreign substances, taking a charge from one electrode and moving with it to the other terminal under the influence of the voltage. This action is similar to that of the moving pith ball between the two knobs of a Holtz machine.

This phenomenon is not known to take place in solids, but it is quite marked in gases, vapors and fluids.

Until recently it was a question of no practical importance in electrical engineering, but with the high voltages now in use or contemplated it may give serious trouble, and apparatus must be designed to check this form of leakage. It was not so long ago that Ferranti's 10,000 volts was looked upon as monstrous, but some experiments of the large companies, of which I have been informed, seem to show that 100,000 volts may be quite practicable, even in quite unfavorable climates. With overhead wire the leakage will merely mean a loss of energy, and the use of porcelain for all insulation, as any oxidizable material (used for instance to protect the primaries of transformer-), would be speedily destroyed by the ozone. Where, however, oil is used in the transformers, the leakage may cause quite serious trouble, owing to the large surfaces and their proximity. In addition, as Prof. Elihu Thomson pointed out some years ago, with high potentials, impurities in the oil are apt to group them-

selves along the lines of highest slope of potential like the iron filings around a magnet, and if, as is generally the case, the impurities have a higher specific inductive capacity than the oil, such a group is thus apt to form a bridge between two points of great difference in potential, hence causing an arc. In those convection currents it is not, I believe, the very small particles which cause the trouble, because small bodies, when charged from a comparatively

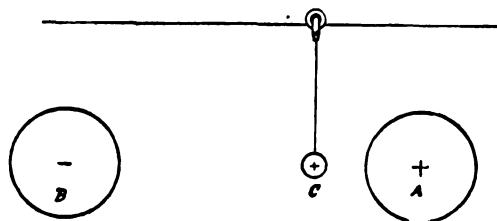


FIG. 1.

The ball *c* having touched *A* and got a + charge, is repelled and moves over to *B* where it gives up its charge, takes up a - charge and moves back to *A*.

large and smooth one are not repelled but attracted; consequently a small grain of dust after touching a highly charged flat conductor would remain close to it if there were no negatively charged particles near it to drag it away or no currents in the oil to wash it off.

The relation between the size of the particle, the voltage and the radius of the charged conductor when the particle after touching the conductor is neither attracted nor repelled, can be obtained by the method of images, but the formula so derived is rather long and complicated and I have not had time to work out the numerical results.

It is evident, however, from it, that for a convective current to take place the radius of the particles carrying the discharge must be a quite appreciable fraction of the radius of the charged conductor. Consequently this form of leakage is due to the motion of a portion of the oil as a whole and not of its individual particles, and if we can break up mechanically these currents we can to a great extent stop the leakage from this cause. This may be done in three ways:

1. By using oil of great viscosity, in which case, however, we lose the chief advantage of oil insulation, i. e., its ability to reinsulate quickly after a discharge.

2. By putting pure dry cellulose in some form or other between the charged surfaces loosely, so that the oil can filter through it easily and any air escape readily, but sufficiently close to prevent any rapid flow. Pure cellulose has the great advantage that when well boiled in the oil it has approxi-

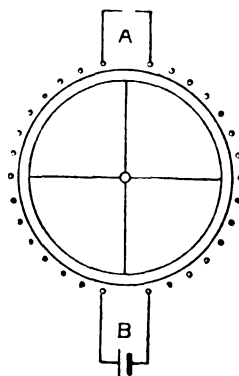


FIG. 2.

mately the same specific conductive capacity as the oil. No varnish or shellac should be used in the oil for reasons given later.

3. By dissolving a solid, non-disassociating substance in the oil in such excess that it crystallizes out at ordinary temperatures, and forms with the oil a soft gelatinous mass, not fluid, but yet capable of allowing the oil to ooze through its substance. This has many of the disadvantages of 1, but it has one advantage, in that the substance chosen may be one like paraffin, having a large specific heat of liquefaction, and consequently an overload will not raise

the temperature of the oil above a fixed point till the paraffin is all melted.

The effect of points in promoting convective discharges in air is well known. It is usually attributed to the great surface density of electricity which a point must take in order to make the potential all over the conductor the same, and hence, since the repulsive force varies as the square of its surface density, it is evident that there will be a great tendency for discharge from a point from this cause. But there is another and very important one, i. e., the fact that, as mentioned above, a particle cannot take a charge and move away unless its radius is larger than a certain fraction of the radius of the curvature of the conductor at the point where it touches the latter; consequently when the charged surface is a plane only large aggregations of atoms can move away; these move slowly and carry small charges in proportion to their mass. But at points where the radius of curvature is very small, small particles can move away with great rapidity and with relatively large charges. Rounding off or flattening the charged surfaces thus acts in a double way, by reducing the surface density and by preventing all but large sized particles moving away.

2. *Conduction in Solids.*—It is not absolutely certain that all conduction is not by convection, but the terms are here used with their usual signification. In solids we do not know as yet exactly how the discharge is handed on, but I have noted a very remarkable fact, which is quite significant and suggestive, i. e., the conductivities of metals are proportional

to the quantity $\frac{\text{elasticity}}{\text{density}} \div \text{valency}$. The following table shows this:

TABLE OF CALCULATED AND OBSERVED RESISTIVITIES.

Metal.	Atom. Vol.	Atom. Wt.	Calc.	R. Calc.	R. Observed.
Silver.....	10.2	108	1	100	107
Copper.....	7.1	63.3	2	126	106
Gold.....	10.2	197	1	135	137
Aluminum.....	10.5	27	3	152	149
Magnesium.....	14	24.4	4	220	275
Zinc.....	9.4	65.5	4	203	332
Cadmium.....	13	112.2	4	456	470
Tin.....	16.2	118	8	1039	878
Thallium.....	17.3	201	6	100	1190
Lead.....	18.2	207	8	14.0	1305
Iron.....	7.2	56	4 or 8	480	646
Beryllium.....	2	9	Unknown.	50 or 100	.....

This fact was discovered by the writer in 1892,* as the result of several years' tedious work in collecting physical data and combining them into formulae to see if any law could be found. Out of the hundreds of combinations tried, this and another one (really the same ultimately, but expressed in terms of other properties), were the only ones which seemed hopeful. It was stated in the article referred to that this formula could not be quite correct. This was for the following reason: Silver, gold and aluminum should, as will be seen from the formula given below, have resistances proportional to the square roots of their densities multiplied by their valencies, i. e., in the ratio of

$$\sqrt{10.6} : \sqrt{19.26} : \sqrt{2.65 \times 3};$$

$$\text{i. e.,} \quad 100 : 136 : 150.$$

Now at this time the best determinations of the resistance of aluminum with which I was acquainted gave it as 193 to silver 100. With such a wide discrepancy therefore between calculation and observation, i. e., 193 instead of 150, it did not seem probable that the high observed value could be modified by subsequent determinations so as to agree with the calculated one. It was, therefore, with considerable pleasure that I saw the recent determination of Messrs. Richards and Thomson (published last year in the *Journal of the Franklin Institute*). Their results for aluminum, 99.66 pure, were:

Aluminum : Silver :: 163 : 100,
and they expressed the opinion that the value for

* Science, July 22, 1892.

* Paper read before the 123d meeting of the American Institute of Electrical Engineers, New York, March 23, 1898.

pure aluminum, when hard-drawn, would be 66 per cent. of the conductivity of copper. This result is so close to the calculated result given in the paper referred to, i. e.,

$$17 : 27 = 100 : 159,$$

though such a high conductivity for aluminum was considered beyond the bounds of probability at that time, that I feel justified in considering that the formula given may be found fairly accurate when more exact determination shall have been made.

This formula throws a certain light on the nature of conductivity in solids, and why some solids are insulators. For the formula $\sqrt{\frac{\text{elasticity}}{\text{density}}}$ is the

same as that for the velocity of sound in a body. Now, in the convective discharge, the electricity was handed on with the same velocity as that with which the particles moved. In fluids, as we shall see, the electricity is handed on with the velocity with which the ions move. In both cases the electricity travels along on the particles of matter.

The idea that electrical flow in solid conductors might also be a simple handing on from one atom to another suggested itself nearly a decade ago to Prof. Lodge. That brilliant and careful reasoner and experimenter, who has cleared up so many patches of scientific jungle, gives a very clear description of the manner in which this would happen if such were the case. I cannot do better than quote him, as it will show how well this idea agrees with all the facts then known but one:

"But if we are not satisfied with this vague analogy, and wish to penetrate into the ultimate nature of heat and the mode in which it can be generated, then we can return to the consideration of a multitude of oscillating and colliding particles, moving with a certain average energy which determines what we call the temperature of the body. If now one or more of these bodies receives a knock, the energy of the blow is speedily shared among all the others, and they all begin to move rather more energetically than before: the body which the assemblage of particles constitutes is said to have 'risen in temperature.' This illustrates the production of heat by a blow or other mechanical means. But now, instead of striking one of the balls give it an electric charge; or, better still, put within its reach a constant reservoir of electricity from which it can receive a charge every time it strikes it, and at the same time put within the reach of some other of the assemblage of particles another reservoir of infinite capacity which shall be able to drain away all the electricity it may receive. In practice there is no need of infinite reservoirs: all that is wanted is to connect two finite reservoirs, or 'electrodes,' as one might now call them, with some constant means of propelling electricity from one to the other, i. e., with the poles of a voltaic battery or a Holtz machine.

"What will be the result of thus passing a series of electric charges through the assemblage of particles? Plainly the act of receiving a charge and passing it on will tend to increase the original motion of each particle; it will tend to raise the temperature of the body. In this way, therefore, it is possible to picture the mode in which an electric current generates heat.

"But although this process may be used as a possible analogy, it cannot be a true and complete statement of what occurs; for it is essentially the mode of propagation of sound. Sound travels at a definite and known velocity, being a mechanical disturbance handed on from particle to particle in the manner described. But heat, being some mode of motion, must also be handed on after some analogous fashion so that when heat is supplied to one point of a mass it spreads or diffuses through it. It is difficult to suppose the conduction of heat to be other than the handing on of molecular quiverings from one to another, and yet it takes place according to laws altogether different from those of the propagation of the gross disturbance called sound. The exact mode of conduction of heat is unknown, but, whatever it

is, it can hardly be doubted that the conduction of electricity through metals is not very unlike it, for the two processes are the same laws of propagation: they are both of the nature of a diffusion, they both obey Ohm's law, and a metal which conducts heat well conducts electricity well also."

I have said, "with all the facts then known but one." This because, as mentioned in the abstract given above, there seemed to be no good evidence for the view that there was any connection between the conduction of sound and of electricity. The reason for this lay in the fact that very few determinations had been made of the velocity of sound in the pure metals, though a considerable number had been made on alloys and commercial materials.*

Consequently no general law could be discovered, though it cannot be doubted but that had the formula for the relation between Young's modulus and atomic volume discovered by the writer† been known at that time, this evidence of a still more intimate connection between sound, heat and electricity would have been discovered by Dr. Lodge.

The formula referred to is:

$$\text{Young's modulus} = \frac{78 \times 10^{10}}{(\text{atom. vol.})^2}$$

Hence it is possible to predetermine the velocity of sound in wires by the formula:

$$\text{Velocity in cms. per sec.} = \frac{883 \times 10^4}{\text{atom. vol.} \times \sqrt{\text{density}}}$$

and the electric resistivity is given roughly by:

$$\text{Resistivity} = 45 \times 10^{-9} \times \text{atom. vol.} \times \sqrt{\text{density} \times \text{valency.}}$$

This formula possesses a general interest, inasmuch as it would seem that while the strain in the dielectric is propagated with the velocity of light, i. e., $\sqrt{k \mu}$, the actual electricity in the wire were handed on with the velocity of sound, and is proportional to $\sqrt{\frac{k}{\mu}}$. The significance of this will be treated of elsewhere.

Suppose a wheel, with elastic spokes and a heavy rim bound outside with a band of horsehair, the horsehair rubbing against a series of violin strings mounted parallel to the axis of the wheel, as shown in Fig. 2. Suppose each violin string has mounted upon it a small metallic bead charged with electricity so that when the strings vibrate the beads can touch. Then on grasping the wheel at B, after a time, depending upon the elasticity and mass of the wheel, a spark will be seen at A, but the actual velocity with which the electricity moves round the circuit of violin strings will depend upon the elasticity and mass of the strings. In passing, we may note several things:

1. That for this analogy to hold at all, the atoms must be charged even in a conductor not carrying current; which is significant when taken in connection with the fact pointed out by the writer in the papers above referred to, that if we calculate the tensile strength, rigidity and Young's modulus on the assumption that these effects are due to charges on the atoms, we get results agreeing very closely with experiment.

2. That in a circuit having many atoms in the cross-section the energy could be handed on without actual contact by electro-dynamic processes.

3. That if one part of the circuit were composed of violin strings tuned to a different note-period from

* I am here moved to again call attention to the fact that an immense amount of physical experimental work is misdirected. It is no doubt quite gratifying to ascertain, after several years' laborious work, that a particular piece of brass or steel of not very definitely known composition and in a quite indefinite physical state has a temperature coefficient of expansion expressed by five significant figures, but such information must be considered as pieces of philosophic virtu, intrinsically worthless, but possibly possessing a value by reason of their uniqueness and associations. I have pointed out elsewhere (*Jour. Frank. Inst.*) that at the present time, in spite of the fact that much has been done, notably by Matthiessen, Roberts-Austen and others, we have not at present any data in regard to 90 per cent. of the more important properties of the simpler metals used in the arts. The importance of having a standard state for solids; of a central bureau to furnish pure materials in a standard physical state to experimenters, and the exclusive use of such materials by experimenters, cannot be overestimated.

† *Elec. World*, Aug. 22, 1891; *Science*, July 22, 1892.

the other we would get effects similar to those of thermo-electricity.*

4. That the reversal of the point of greatest drop of potential in a circuit of air and carbon from the + to the - electrode as the pressure is reduced may be due to the fact that, as shown by the beautiful experiments of J. J. Thomson, the molecular conductivity of air at low pressures is extremely high, the electrode heated thus depending upon whether the solid conducts better than the gas, or vice versa.

5. That this same formula would also be applicable to a diffusion phenomenon, and indeed the presence of valency in the formula makes it exactly analogous to that for the diffusion of heat. Moreover, Roberts-Austen, in a series of striking experiments, has shown that diffusion can take place in solids at ordinary temperatures. If a current be however a diffusion, it may be shown that for fairly large current densities the atoms must move several cms. per second, and we might therefore expect interpenetration when brass and zinc terminals are joined. But this does not occur to any considerable extent. We may also take it as an electrolytic diffusion, as is suggested by J. J. Thomson in his "Dynamics Applied to Physics and Chemistry," but in this case, even assuming the theory suggested by him to account for some atoms preferring a plus to a negative charge. I find it difficult to imagine the manner in which the atoms could be charged and discharged at the surface of the conductor. It is to be noted that in gases the phenomenon of diffusion sound velocity and heat conductivity are all linked together.

It will be noticed that in the table given, while the metals follow each other in the order they should from calculation, yet the agreement is in some cases not so close as in others. This may arise from several causes:—1. The conductivities of but few of the metals are accurately known. 2. The elasticities of but few of the metals are accurately known, and the formula given for the Young's modulus only roughly takes temperature into account. 3. The temperature coefficients of the metals are not the same. For instance, that for copper is over .4 : .415, having been obtained by Swan and Rhodin, and .404 by Kennelly and the writer, whilst silver is only .38 and gold .36. Consequently the ratio will vary with the temperature, and at higher temperatures the ratio resistivity of copper : resistivity of silver will be less. This, it is interesting to note, holds true for the velocity of sound, for from Wertheim's results we have, velocity of sound in silver : velocity in copper = 1.35 at 20° C., and only 1.19 at 200° C., and hence, just as in the case of electrical conductivity, the sound conductivity of copper diminishes at a faster rate than that of silver.

The magnetic metals, as iron and platinum, are very difficult to obtain pure. Their true resistance is therefore at present doubtful.

What has been mentioned thus far concerning the resistance of solids has had no immediate bearing on the subject of insulation. It was necessary, however, in order to introduce the following considerations.

(To be continued.)

The International Ohm.

In view of the impending publication of the bill concerning electrical units of measurement, the *Elektrotechnische Zeitschrift* states that the German Imperial Post Office authorities have resolved to introduce the ohm in place of the Siemens unit. In future all new apparatus and measuring instruments will be standardized in ohms. Existing curved handled rheostats and resistances used in connection therewith will at once be rearranged, whilst other apparatus and instruments will be similarly dealt with on being sent to the work-shops for repairs as occasion may arise. Statements of resistances in official reports will in future always be expressed in ohms.

* Compare the analogous problem of two portions of gas of different densities in a closed ring tube and junctions heated. Neuman, "Jahrbücher f. Chem.," 1814, p. 15.

A NOVEL HIGH TENSION SERIES ENCLOSED ARC SYSTEM.

BY J. H. HALLBERG, E. E.

Articles have appeared in the pages of *ELECTRICITY* describing the enclosed arc lamps and calling attention to their many advantages, but the writer has not seen any particular attention called to the high tension series enclosed arc lamps, which have now been perfected and are manufactured by a few firms. Probably the reason of this silence is that the manufacturers have not met with such success in designing and operating lamps on this circuit as would warrant their recommendation for street and commercial lighting.

I will first take up a few questions as to the requirements of the enclosed arc lamp for high tension series street lighting and commercial circuits. The insulation should consist of mica, lava and porcelain; fiber should never be used in arc lamps except for switch handles. When testing insulation, it is best that you should not depend on the ringing of a magneto bell, but should take one wire from the magneto in operation and connect to the ground or to frame of dynamo or cover of lamp, then the other wire should be attached to a small handle and taken in one hand, while with the other you touch some connection or bare wire in sure contact with circuit; to be perfectly sure, wet your hands; it is understood that you must be insulated from the ground. I have found this method to be the surest where no special testing apparatus is at hand, as you will surely feel the current from the magneto if there is a leak. Never depend on ordinary insulation in high tension series lighting, as the extremely high pressure of the "kicks" caused by flashing of the dynamo or the breaking of a wire will break through any ordinary insulation and consequently ground lamps and apparatus. The lamp should be provided with a standard hanger, and so designed that it will fit in the majority of hoods with the hanger-boards now in use. The lamp should be provided with a cover that is easily removed for inspection. The lamp should be proof against snow or rain, and as nearly dust proof as possible, and at the same time ventilated.

All parts should be easily interchangeable, with the use of no other tools than a pair of pliers and a screwdriver. My experience has been that it is better to use binding-posts and connectors than solder, for various reasons, the main one being, a coil can be changed without the troublesome use of a soldering iron. The out-out should be positive in its action and have a sure adjustment, and its contact points should be easily interchangeable. It is preferable that the clutch works direct on the carbon, as the wear of the clutch is thus reduced on account of the softness of the carbon. The lamp should be equipped with some device to prevent the slipping of the carbons. In a differential lamp the slipping could only happen during its burning, as the carbons are together during the day, or when the lamp is not working. In a shunt-wound lamp the device should always be in action, as the carbons in a shunt lamp are always apart except at the moment that the arc is struck. This device may seem unnecessary, but experience has proven that the best of clutches will slip in stormy weather, especially on lamps placed on tall poles, or if they are suspended from poles which also carry one or more trolley wires.

The inner globe should be easily interchangeable, as when trimming a number of lamps it is demonstrated that it is best to exchange the dirty inner globes for clean ones, and bring the dirty globes and what is left of the upper carbon back to the station, where the former are cleaned and the carbons are cut to the right sizes for negative or lower carbons for the next trimming. The lamp could be so designed that it would maintain the same voltage at the terminals and arc, whether the amperes be 4 or 7, varying, or any constant between these two

numbers. A lamp designed for 4 amperes should operate on any amperage between 4 and 7. The arc in the lamp should continue the entire voltage as measured at hangers except one volt. This one volt is all that is necessary to hold the out-out open. When the lamp is out out by its automatic out-out not over 4 volts should be expended when the lamp coils are hot. The shunt coil and out-out should not consume over one-tenth ampere when lamp is hot. If possible, the lamp should be so designed that no dashpot or springs are required in its mechanism. This is very important, as all of our readers have probably experienced more or less trouble from dirty dashpots, feed and out-out springs. In many cases these lose their tension, which would either keep the lamp out entirely or destroy all adjustment, allowing the lamps to burn 30 to 70 volts instead of 45 to 50. The writer knows of some out-outs that would not shunt the lamp until the arc reached about 140 volts. This, of course, would burn the shunt coils in the lamp, as they were only designed to stand a maximum of 70 volts. I believe all will agree with me that a spring and a dashpot are the most frequent causes of trouble on a high tension street lamp which is subjected to internal heat and to dust and dampness. The lamp should be of light weight, say 25 lbs. complete with hood, hanger-board and globe, so as to allow the use of lighter construction and suspensions; a light lamp will also make the old balancing weights unnecessary, and on shipments of lamps the freight is about one-half of that paid for old-type long and heavy lamps. The lamps should be adapted for either inside or outside service without change; at the same time they should be so designed that if necessary the plain cover can be substituted for a fancy one without any changes on the lamp. The lamp should be as short as possible, say about 24 inches from top of hanger to bottom of globe, so as to allow the lamp to be used in low-studded buildings, basements and hallways. If it should be necessary to have a long lamp in order to suit some particular customer, it can be done by simply putting on a longer cover without changing the mechanism of the globes. The lamp should regulate so that its voltage would not vary over 5 volts at any time from normal. The lamp that is designed and built so as to come up to the above specifications should certainly meet with the approval of most station managers and electrical engineers. Since the invention and perfection of the enclosed arc lamp it is possible to build a lamp of the type above mentioned, and the writer after personally handling nearly 100 of them for street lighting purposes during the past ten months, has come to the conclusion that it is the most convenient street lamp and will surely occupy a prominent position among the enclosed arc lamps, as it possesses higher efficiency than any other type of enclosed arc lamp as yet advertised in this country.

The light from the high tension enclosed series arc lamp possesses all the advantages that are so noticeable in the low tension D. C. enclosed lamp, which are: a perfectly steady light, perfect diffusion and distribution, the tint of which can be governed by the use of different combinations of globes. It burns from 100 to 150 hours with one 12 by $\frac{1}{2}$ solid "imported" carbon. This not only saves labor in trimming and attention, but the lamp mechanism and clutch do not wear as the lamp feeds only a few times every 12 hours. It must also be remembered that the clutch works on the soft carbon, which prevents it from wearing, and as there are no carbon rods, the repairs on an enclosed arc lamp are only about 10 per cent. of that for the open arc system. If we now get a lamp as per above suggestions it would be perfectly proper to ask the following question, if you do not already realize the economy of a plant equipped with this type of lamp for street lighting: How do these lamps compare with the open arc system in regard to amperes, voltage and candle power? The old-type open arc lamp requires 10 amperes and 45 to 50 volts (equal to 500 watts) to

produce what is known as 2,000 nominal candle-power. The new enclosed arc lamp with clear globes requires 7 amperes and about 71½ volts (equal to 500 watts) to produce 2,000 nominal candle-power. From the above figures you can see that the wattage remains the same for both types of lamps, consequently your coal bill is not increased when you use the enclosed series lamps. The enclosed arc lamps require about 30 per cent. higher voltage, but the amperage may be reduced accordingly. I consider this a great advantage, especially if your circuits are very long, as the line loss would be cut down considerably. If you desire a 1,200 candle-power system your wattage consumption would be about 300 to 325 (equal to 4 amperes and 80 volts, or 5 amperes and from 68 to 70 volts). I mentioned in the early part of the article that a shunt wound high tension series enclosed arc lamp could be so designed that it would operate with the arc voltage even though the amperage varies about 40 per cent. You will undoubtedly see the advantage of this. To-day you will find that almost any manufacturer of arc dynamos will furnish regulators and controllers, by the adjustment of which you may change the amperage from, say, 4½ to 6½ amperes and the dynamos will hold their amperes very steadily at any point. This enables you to get a perfectly controllable arc circuit, which may be varied at will from the station.

On dark nights you may run your dynamo at 7 amperes. The next night may be moonlight; then you can cut your dynamo down to, say, 5 or 6 amperes; then, during winter, when snow is on the ground, you will not need over, say, 5½ amperes on the darkest nights. On moonlight nights with snow on the ground you could probably go as low as 4½ amperes on your circuit and still you would light your streets equally as well as you would on a very dark night with 7 amperes. This feature of this system will save a station or a town a good many dollars. Figures show the following:

200 lamps at 70 v. each = 14,000 v. \times 7 amp. = 98,000 watts.

200 lamps at 70 v. each = 14,000 v. \times 4½ amp. = 63,000 watts.

This shows a saving of 35,000 watts per hour. If your plant can produce one electrical H.P. per hour with four lbs. of coal, you would save during an 11 hour run on 4½ amperes instead of 7 amperes about one ton of coal, equal to, say, about \$2. By applying this system I am sure a great many plants which now shut down at 12 P.M. could persuade the town which they light to pay a little more and run on a very low amperage the rest of the night, and then it might be profitable to run an all-night incandescent circuit. I am sure lighting plants in small towns could get many new customers on their incandescent circuit if they could afford to run until daylight instead of shutting down at 12 P.M. These are only a few examples showing the many advantages that can be gained through the use of this system. There are many stations which have 4 to 7 ampere dynamos that are not in use, for, as the town grows, the requirements change, a larger light is wanted and a 10 ampere arc system has to be put in. Now, clean and fix up your old 4 to 7 ampere dynamos, write for prices and information to arc lamp manufacturers who make a high tension series enclosed arc lamp. Be sure that the manufacturers guarantee the lamp to burn on a varying amperage of, say, about 5 without change in the voltage at hangers, as your old-type dynamo may not regulate as well as the later designed and improved lamps. So you see, if the town board should vote to put in 15 or 20 new 2,000 C.P. arc lamps, and your present 10 ampere dynamos are loaded, you can, if you have an old 5½ ampere dynamo, by simply buying this type of lamp and putting up new circuit, turnish the town with this lamp and save the cost of a new dynamo. The foregoing explanations and suggestions might alone show station managers how they would profit by the use of an arc lamp of this type, but I will now call your attention to the most important

fact, and that is, that this lamp operates for 125 hours without any attention or trimming. At each trimming there is used only one $12 \times \frac{1}{2}$ " solid "imported" carbon. The cost of this quality of carbon is between \$27 and \$30 per 1,000, consequently a lamp of this kind, if operated 10 hours every night in the year, will consume 30 of these carbons per year, equal at highest carbon price to 90 cents. If your carbons for the old-type open arc lamp cost you \$15 per thousand pair, delivered (this is certainly the lowest cost figure), then a lamp of that type which consumes one pair of carbons each night of 10 hours requires 365 pair for one year, equal to \$5.47½, and making a saving of \$4.57½ each year per lamp in carbons alone.

As the enclosed arc only needs trimming once every ten or fifteen days, one or more trimmers may be dispensed with. The enclosed arc having an inner globe, a deduction of about \$1.00 per year for each lamp might be made from the above figures to allow for the additional chances of breakage.

American Institute of Electrical Engineers.

At the meeting of the Institute held at 12 West 31st street, New York, Wednesday evening, March 23, a paper was presented by Prof. Reginald A. Fessenden on "Insulation and Conduction." About 75 members and guests were present, with President Crocker in the chair.

In the absence of the author, the paper was read by Mr. R. W. Ryan and discussed by Prof. Franklin and Dr. Pupin.

The secretary announced that at the meeting of council in the afternoon the following nominees had been selected from the proposals submitted by the membership:

For President—Arthur E. Kennelly.

Vice - Presidents—Robert B. Owens, William Stanley, Cary T. Hutchinson.

Managers—Herbert Lloyd, Samuel Sheldon, George F. Sever, Chas. P. Steinmetz.

Treasurer—Geo. A. Hamilton.

Secretary—Ralph W. Pope.

The following officers continue their terms as provided in the constitution: Vice Presidents—A. E. Kennelly, Chas. S. Bradley, D. C. Jackson; Managers—J. W. Lieb, Jr., F. A. Pickernell, W. L. Puffer, L. B. Stillwell, Alexander MacFarlane, W. F. C. Haddon, Gano S. Dunn, Herbert Laws Webb.

The question of Standardization of Electrical Machinery was referred to a special committee composed of Elihu Thomson, Francis B. Crocker, A. E. Kennelly, C. P. Steinmetz, C. T. Hutchinson, J. W. Lieb, Jr., and L. B. Stillwell.

The following associate members were elected:

Albert G. Davis, acting manager patent department General Electric Company, Schenectady, N. Y.
Albert R. Gallatin, student of Columbia University, New York City.

Herbert Gaytes, electrical engineer Realty Syndicate Railways, Oakland, Cal.

Russell Agnew Griffin, purchasing agent American Telephone & Telegraph Company, New York City.

Francis Valentine T. Lee, engineer Pacific Coast department Stanley Electric Manufacturing Company, San Francisco, Cal.

Max Lowenthal, associate editor the *Electrical Engineer*, New York City.

Henry W. Pope, special agent American Telephone & Telegraph Company, New York City.

Fritz Reichmann, instructor of physics, University of Texas, Austin, Tex.

Theodore E. Theberath, Pacific Coast engineer Stanley Electric Manufacturing Company, San Francisco, Cal.

Robert Anton Fliess, student of electrical engineering, Columbia University, New York City.

The opening date of the General Meeting at Omaha was fixed for June 27, and its continuation for either three or four days has been left with the Committee on Papers and Meetings for decision.

THE WESTERN TELEPHONE CONSTRUCTION CO.

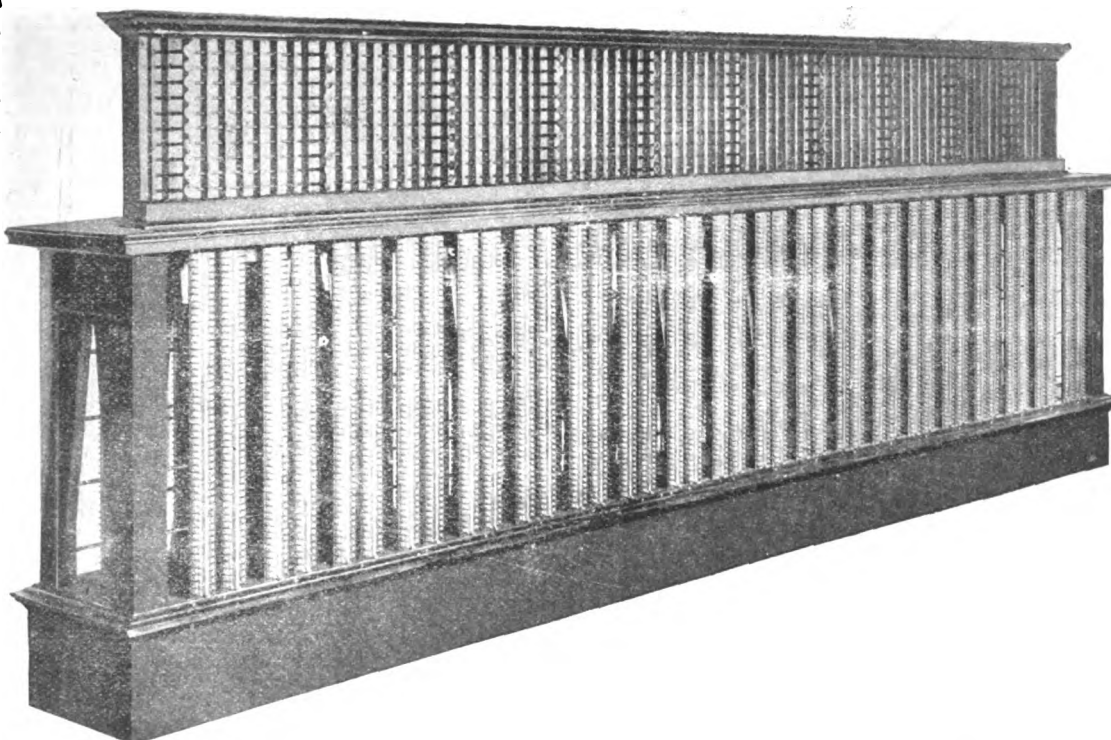
Officers Elected at the Annual Meeting—Increasing Its Manufacturing Facilities—New Types of Apparatus.

At the annual meeting of the stockholders and directors of the Western Telephone Construction Company in Chicago on the 14th of this month, the following officers were elected:

President and General Manager—James E. Keelyn.

Vice President—Judge D. A. Holmes.

Secretary—B. F. Stewart.



WESTERN TELEPHONE CONSTRUCTION COMPANY'S 2,000 LINE DISTRIBUTING BOARD.

Mr. Keelyn's name will be recognized as the former president of this company. He is already well known and popular with the electrical fraternity.

Judge Holmes is a well-known lawyer in Chicago, of the firm of Mason, Holmes & Mason, of which Senator W. E. Mason is the senior member.

Mr. B. F. Stewart will be recognized as an old-timer in the electrical business, he having formerly been manager of the Western Electric Company's factory and in later years well known throughout the country from his important connection with the Westinghouse Electric & Manufacturing Company.

The Western Telephone Construction Company reports that it has again been forced to make an increase in its manufacturing facilities. It is therefore making an addition to its factory which will give it half as much space again as it now occupies. New machinery is being purchased and preparations are being made in every direction for the most active season in the history of this company. The sales so far this season have eclipsed anything in the history of the company, and large orders are coming in so rapidly that they are handled with the greatest

difficulty. Several new types of apparatus have recently been put on the market by the company which deserve special mention.

The accompanying plate shows a 2,000 line distributing board, which has recently been built and installed in a number of exchanges equipped with the Western apparatus. This board is a combined lightning arrester, distributing and test board. The line cables after entering the exchange pass to the lightning arrester side of the board, where their respective wires are attached to the terminals provided on the lightning arrester clips. The circuit of each line is then continued through a fusible cut-out and static arrester, and thence by means of jumper wires to its proper position on the other side of the board, where the ends of the jumper wire are attached to the terminals provided on the test clips. From the other side of these test clips cables are again formed which run to the drops and jacks in the switchboard.

The arrangement is such that there is no confusion whatever in the jumper wires, which lie in parallel troughs or passages, and a tangle is thus made almost an impossibility. The arrangement for testing any line afforded by this board is very complete. A special test plug may be inserted under any of the test clips and the circuit tested in either direction—that is, towards the switchboard or towards the sub-

scriber. If desired the test telephone may be simply bridged across the circuit at that point of the line being tested without breaking the continuity of the line between the subscriber and the switchboard. This board is extremely compact, and the rapidity with which a change may be made in the distribution of the lines between the various terminals is surprising.

The instruments and apparatus manufactured by the Western Telephone Construction Company are continually growing in favor, and the demand for them keeps pace with the fast increasing popularity of telephonic communication in all sections of the

country where independent systems have got a foothold.

The New York Electrical Society.

The 186th meeting of this Society will be held at the College of the City of New York, Lexington avenue and 23d street, New York City, this (Wednesday) evening at 8 o'clock.

Mr. Frank E. Knight will read a paper on "The Influence of Electric Railroads on Population and Land Values in Cities."

After this paper, Mr. W. J. Clarke will give a practical demonstration of the Marconi system of wireless telegraphy by means of an improved apparatus. On behalf of Mr. John Denuis, Jr., the inventor of the fluorometer, Mr. Clarke will also describe the operation of that instrument as a surgical adjunct of the X-ray.

The General Electric Company owed on January 1, 1893, \$1,339,360 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Supreme Court of Wisconsin has rendered a decision to the effect that there can be no extension of street railway lines beyond city limits, even though a franchise has been granted, without the award of damages where property owners object. It also makes no difference whether or not the companies have the right to carry freight or express matter.

Judge O'Neill has filed an order consolidating the two actions in the suit concerning the receivership of the National Electric Manufacturing Company at Eau Claire, Wis., making H. H. Hayden and J. T. Barber defendants, and Morgan Brooks of St. Paul, Edward P. Allis Company, Milwaukee, the Eureka Tempered Copper Company and others plaintiffs. He also made T. F. Frawley, Fitch Gilbert, R. E. Rust, George T. Thompson, John S. Owen, D. R. Moon, A. J. Rust, Bank of Eau Claire, Chippewa Valley Bank and Westville Lumber Company defendants. He likewise vacated Judge Bailey's three orders of December 30, closing up the receivership. Judge O'Neill also removed Receiver R. E. Rust, but the judge spoke in complimentary terms of Mr. Rust's high standing and said his removal from the receivership was due only to the fact that his being a defendant made such action by the court a necessity.

In the suit brought by the Port Huron Electric Railway Company against the Guarantors' Liability & Indemnity Company, Judge Vance in the Circuit Court at Port Huron, Mich., on the 18th inst., took the case from the jury, directing a verdict for the street railway company for the amount of \$1,136. The suit was brought to recover the amount of a judgment awarded Conrad Lutz in the Circuit Court against the street railway company for injuries sustained a year ago last November in a collision between a street car on which Lutz was a passenger and a Grand Trunk engine. The street railway company was insured with the indemnity company against damages recovered by passengers for injuries sustained in accidents. The company, however, refused to pay the Lutz claim claiming exemption owing to alleged negligence on the part of the street railway company.

The American Range Finder Company, a West Virginia corporation engaged in manufacturing and selling range finders and other instruments, made an assignment on Wednesday last to Charles B. Van Nostrand, New York, who is understood to be the principal owner of the company. Edward A. Wickes, New York, is president of the company, and John Nisbet of Yonkers secretary. The company was incorporated in 1888 with a capital stock of \$500,000 to manufacture a range finder, invented by Lieutenant Fiske, to determine the distance and location of ships at sea. The concern had no factory, and its instruments were manufactured for it by the Western Electric Company, and sold on royalty.

A Patent Office Bill.

A bill has been introduced in the U. S. Senate by Mr. Platt of Connecticut, providing for an increase in the working force of the Patent Office, in order to facilitate the work of the office, which is greatly in arrears. The bill provides that for the purpose of determining with more readiness and accuracy the novelty of inventions for which applications for letters patent are or may be filed in the Patent Office, and to prevent the issuance of letters patent of the United States for inventions which are not new, the Commissioner of Patents is authorized and directed to revise and perfect the classification, by subject-matter, of all letters patent and printed publications in the United States Patent Office which constitute the field of search in the examination as to the novelty of invention for which applications for patents are or may be filed.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Albany, N. Y.—The bill introduced by Assemblyman Eldridge, which is believed to validate all the grants of the Union ("Huckleberry") road in New York City, was passed in the Senate by a vote of 29 to 10.

Atlantic City, N. J.—Surveys have been completed for a new electric railway to run direct from Camden to this city. The new line will leave Camden and cross Cooper's Creek near the head of Harleigh Cemetery, passing down through the outskirts of Haddonfield, then to Ellensburg, Gibbstown, also Pleasant Mills, Weekstown, Unionville and Port Republic, and thence down the shore road to Absecon and across the meadows to this city. The corporation is known as the New Jersey Electric Railway Company, and is incorporated for \$3,000,000, the projectors being Philadelphia and Atlantic City capitalists. The third-rail system will be employed, and the cost of the road is estimated at close to \$2,000,000. Ninety-pound rails will be used on the road, and the line will cross the meadows on an elevated steel structure.

Baldwinsville, N. Y.—The commissioner of highways has granted the Baldwinsville & Liverpool Railway Company a franchise to construct an electric road and lay tracks on the highways running from Liverpool to the limits of Baldwinsville.

Buxton, Me.—The building of the Saco River electric road now appears to be certain. Its promoters have issued \$300,000 twenty-year 5 per cent. gold bonds, and floated them with the Massachusetts Loan & Trust Company. The Railroad Commissioners have already approved the location of a route which passes through the villages of Bonny Eagle, Standish, West Buxton and Bar Mills to Saco. The gauge of the road is 4½ inches. The construction of the road will be rushed in order to have the line ready for travel by July 4. It is the theory of the projectors that the road will open the way for the utilization of the immense water power now dormant in the Saco river.

Chattanooga, Tenn.—The passenger lines of the Chattanooga Belt Railway have been formally transferred to the Chattanooga Rapid Transit Company, of which S. W. Divine is president. Mr. Divine says there will be no change in the operation of the road until he is ready to put in the electric system.

Danville, Ill.—The thirty year franchise ordinance of the Danville Gas, Electric Light & Street Railway Company was passed over the mayor's veto by a vote in the council of three to one.

Hartford, Conn.—The directors of the New England Railroad Company have decided to extend the third-rail system to Bristol. They expect to have the line in operation early in June.

Lafayette, Ind.—Col. William Sears of Chicago, one of the promoters of the electric railway projected to be built between Goshen, Ind., via Danville, Ill., to St. Louis, has called a meeting of the capitalists interested in its construction to be held at Plymouth, April 11. Two surveys have been made, each over a different route, and those interested in the enterprise are confident of having construction under way before May 1.

Lockport, N. Y.—The "Journal" has been authorized to state that "an electric railroad between Lockport and Buffalo is now a certainty and will be in operation within three months. The Ely Company has positively leased the Lockport Buffalo branch of the Erie and the work of putting in a third rail, erecting poles and trolley lines and all other necessary regulations will be under way in a short time. Surveyors and engineers are at work now along the line between here and Buffalo under the direction of Erie and Ely officials."

Marlboro, Mass.—Within a few weeks it will be possible for West Warren people to take a trolley ride into Boston, and from there, if so disposed, to Nashua, N. H., the whole trip being more than 100 miles. When the short connecting link near Marlboro is completed, the people along the line, in the Brookfields, Spencer, Worcester, Marlboro and South Framingham, will be on a continuous electric line, and can go to Boston by trolley. The connecting link necessary to make this possible lies between Marlboro and South Framingham, and it has been decided to make the connection with all possible dispatch.

Montpelier, Vt.—The board of trade are considering the plan of building an electric railway from Rochester through Hancock, Granville, Warren, Waitsfield, Moretown and Middlesex to this city. A committee consisting of Fred Blanchard, H. C. Gleason, L. Bart Cross, Collins Blakely and H. W. Kemp have been appointed to correspond with parties interested with a view to ascertaining the feasibility of such a project.

New York.—An immense power house is to be erected at Kingsbridge by the Third Avenue Railroad Company at a cost, including the plant, of at least \$5,000,000. The electric machinery is to have a capacity of 4,000 horse-power, the purpose of the company being to have the motive power for their whole system generated there, and to change all their lines into electric within three years.

New Kensington, Pa.—The borough council has granted the New Kensington Street Railway Company

a 99-year right of way to lay a single street car track over Fifth avenue the entire length of the borough from Parnassus to Arnold. T. A. Mellon, Jr., is president of the company and D. T. Marsh, Pittsburg, secretary.

New Haven, Conn.—The New York, New Haven & Hartford Railroad Company has decided to build an extension of its Nantasket Beach electric system between East Weymouth, the present terminus of the road, and Braintree. With the completion of this extension the company will have 15 miles equipped with electricity.

Norfolk, Va.—The Norfolk & Ocean View Railroad eight mile electric line, which has been in the hands of receivers for a year, has been sold by order of the United States Court to the Norfolk Street Railway Company, for \$329,000.

Penn Yan, N. Y.—All the preliminary work, including the survey, has been completed by the Penn Yan & Geneva Electric Railroad Company, and an application will at once be made to the State Railroad Commissioners for a charter. F. B. Hubbell of Baltimore, Md., the promoter of the road, states that the necessary capital is in sight and will be forthcoming unless war with Spain is proclaimed.

Pittsburg, Pa.—The Pittsburg "Times" says: "A big scheme, and it will not be of such very gradual accomplishment either, to gridiron the Monongahela and Youghiogheny valleys with electric lines, is in a formative condition just now. The sag ends of the scheme are already built, and it will only require the construction of a few miles up each of the valleys to connect Pittsburg by new lines with Braddock, McKeesport, Elizabeth, Monongahela City, Charleroi, Bellevue, California and Brownsville, and eventually Morgantown and Fairmont, in the Monongahela valley, and McKeesport, Versailles, West Newton, Smithton, Layton's, Dawson, Broadford, Connellsville and Uniontown up the Youghiogheny."

Republic, Wash.—E. R. Gray, I. M. Fisk and T. W. Butler, of Kettle Falls, are reported here to be organizing a company for the purpose of establishing an electric car line into this camp.

Reading, Pa.—The right of way along the entire route of the Reading & Royertown Electric Railway has now been secured, and the construction of the road is being pushed rapidly. This road will pass through a large number of villages and settlements, heretofore inaccessible by rail, for a distance of about twenty miles.

Saginaw, Mich.—The receivers of the Union Street Railway presented figures showing that they were losing money at the old rates of seven and nine for a quarter, and Judges Snow and Wilber have granted them permission to raise the rates.

Sistersville, W. Va.—Engineers are surveying the proposed route of the Sistersville & Salem Railway, to be built between this city and West Union. The right of way has been secured from this city to Middlebourne and as soon as the engineers establish the grade work will be commenced. It will be one of the longest electric lines in the country, the distance from here to West Union being about 50 miles.

Tiffin, O.—Samuel B. Sneath, builder and owner of the Tiffin & Postoria electric road, which is in operation as far as Bascom, has transferred the road to a company whose officers are: President, D. E. Kimberly, Cleveland; vice president, Mr. Gabriel, Cleveland; secretary, C. O. Everett, Cleveland; treasurer, S. B. Sneath, Tiffin, who, with B. G. Tremaine, Cleveland, compose the board of directors.

Westbrook, Me.—The directors of the Westbrook, Winham & Harrison Electric Railway Company have voted to accept the locations granted by the several towns through which the road is to pass. The work of construction will probably begin at an early date.

Wildwood Beach, N. J.—A party of Philadelphia capitalists, headed by Morris M. Neurath, have organized the Five-Mile Beach Railway Company, and they will shortly commence the building of an electric trolley road the entire length of Five-Mile Beach, connecting the resorts of Holly Beach, Wildwood and Anglesea.

LIGHTING PLANTS.

Bad Axe, Mich.—At an election held here on the 14th an informal vote was taken on the question of municipal purchase of the electric light plant, 190 voting in favor of buying the plant and 72 against. The franchise of the present owners gives the village the right to buy within a specified time at actual cost.

Brooklyn, N. Y.—The Edison Electric Light Company has begun stringing wires on the poles of the defunct Coney Island & Gravesend Electric Light Company, purchased by them from the Citizens' Company, which bought the franchise granted by the town. Lights will be introduced by the 15th of April.

Burlington, N. J.—The Monmouth Traction Company, which is applying for right of way through this city, has just completed a contract for lighting the city for \$4,000 a year for five years, conditional on getting a franchise to build and operate the trolley system.

Chillicothe, O.—The Juneman electric plant, which has been doing the city lighting, passed into the hands of the Chillicothe Street Railway Company on the 18th inst., the consideration being \$25,000. The railway company proposes to reduce the cost of the city lighting \$1,650 a year.

Cranford, N. J.—The township committee has granted a 99 year franchise to string wires for lighting in the township to the Cranford Light & Water Company.

Des Moines, Ia.—The so-called curative act permitting the carrying out of the McKaskey-Holcomb contract for the erection of a municipal electric lighting plant has passed both houses of the Legislature.

Milwaukee, Wis.—Bids will be received by the board of public works on Friday, April 15, for the gas and electric light fixtures for the Public Library and Museum building. It is expected that these fixtures will cost about \$16,000. Bidders will have to put up bonds to the amount of \$5,000 or \$2,500 in cash. In order to get the full benefit of competition the board of public works has mailed copies of the advertisement and the specifications to manufacturers of gas and electric light fixtures in New York, Philadelphia and Chicago.

New Albany, Ind.—The council is expected to take early action on the question of lighting the entire city with electric arc lights, doing away with the sun vapor lights.

Petoskey, Mich.—At the spring election next month the voters of this place will have a chance to express their opinions on a bonding proposition for \$6,000 for a municipal lighting plant.

Pomeroy, O.—George Pfarr, Henry C. Pownall and George Cowey, who compose the Mutual Electric Company, have been granted the right to maintain and operate a system of electrical distribution in this city for a term of twenty-five years.

Richmond, Mich.—The proposition to bond the village for \$9,000 to establish an electric light plant was carried at the late election by a vote of 204 to 69.

Rogers City, Mich.—Electric lights are spoken of as among the probabilities in the contemplated village improvements.

Rockville Center, L. I.—At the recent election here, the appropriation of \$2,000 for completing the electric light plant was carried by a vote of 101 to 32.

Sac City, Ia.—The Sac City Electric Company has accepted the provisions of the ordinance giving it a lighting franchise and will proceed to let contracts for the construction of an electric light plant.

Trenton, N. J.—A bill has been introduced in the House by Mr. Porter which gives the Board of Street and Water Commissioners in cities of the first class entire control and authority to provide for the public lighting of all streets, avenues, lanes, alleys, highways, docks, bridges, parks and public buildings of such city.

Watertown, S. D.—This city is soon to have a new electric light plant. Col. L. D. Lyon, representing the Watertown Water, Light & Power Company, has been canvassing the city and has secured a guarantee of 1,000 lights. The city will grant a franchise and take a number of lights for street lighting. For the past two years Watertown has been without electric lights, the old plant constructed by the General Electric Light Co. in 1888 is worn out, and the franchise has lapsed. The new plant will be of modern construction.

COMPANY MATTERS.

Albany, N. Y.—Senator Malby's bill, enabling the St. Lawrence Power Company of Massena, St. Lawrence county, to operate its canal for navigating purposes and to furnish a water supply, water power, or to generate electric power to be used by any city, town or village wishing to contract therefor, has passed the Senate.

Annapolis, Md.—A bill has been introduced in the House to incorporate the Electric Power & Light Company of Baltimore County. The company is authorized to lay wires in the county for the transmission of electricity for heating, lighting or motive purposes; capital stock, \$25,000. Henry Keidel, William H. Matthai and James O. Bates of Baltimore county; John W. Lowe, James C. Doyle, Theodore M. Easter and John W. King, of Baltimore City, are named as incorporators.

Bangor, Me.—The Bangor Electric Clock Company, of which Gen. J. S. Smith is vice-president and general manager, have temporarily located their factory in the new Sudbury building on Sudbury street, Boston, Mass., where they are busy perfecting the machines and getting out sample clocks which will be sold all over the country. Every part, even to the smallest screw that goes into the make-up of these clocks, is now made by the company and a great many of the tools had to be specially constructed for this work.

Dayton, O.—The Thresher Electric Company contemplates an extension of its plant and works.

Gettysburg, Pa.—Capitalists interested in the Gettysburg Transit Company will, on April 14, apply for a charter for a corporation to be called the People's Electric Light, Heat & Power Company of Gettysburg. It is rumored that extensive improvements will be made on the electric railway. Among those interested in the enterprise are Henry A. Sage of Easton, Henry Green and Frank Reeder of Easton, Henry A. Boreel, William E. Burk, J. Darlington, William Henderson, Joseph T. Richards, Max Riebenack and Theodore P. Saulnier of Philadelphia.

Lancaster, N. H.—The electric companies of this region are to be consolidated under the name of the Northern Electric Company, comprising the Lancaster, Jefferson, Whitefield and Bethlehem companies, with a capital of \$100,000. The main power house will be at Bethlehem, and the offices and headquarters at Lancaster.

Middletown, N. Y.—A controlling interest in the Middletown-Goshen Traction Company has been sold to

a syndicate of New York capitalists, who have taken possession of the road. The officers of the new company are: President, F. McKeige; vice-president and treasurer, C. G. M. Thomas; secretary, H. M. Brundage; general manager, W. A. Grauten. The new owners intend to make several improvements. It is probable that a lighting plant will be established in connection with the railway.

Pittsfield, Mass.—The directors of the Pittsfield Electric Street Railway Company have voted to increase the capital stock from \$60,000 to \$80,000, provided the Railroad Commissioners grant permission to do so. The object of the increase is to build a new line to Tillotson, about two miles to the west.

Schenectady, N. Y.—The General Electric Company has let the contracts for its new foundry, and is having plans prepared for a machine shop of imposing dimensions.

TRANSMISSION PLANTS.

Atlanta, Ga.—It is said that the new electric power company which proposes to dam the Chattahoochee River and establish an immense plant for the generation of electricity will soon be ready to commence work on the project. The object of the company is to furnish electricity to manufacturers and other consumers in Atlanta and throughout Fulton county.

Visalia, Cal.—Mayor William H. Hammond of this city, A. G. Wishon, manager of the city waterworks, and W. G. Henshaw of the Union National Bank of Oakland have associated themselves in an enterprise of considerable importance. They propose to utilize the waters of the Kaweah River at a point about thirty miles east of here in operating an electric generating plant from which to transmit about 1,000 horse power to this city and neighboring towns. The plant and its appurtenances will cost about \$200,000. Work is expected to begin in a few days.

FIRES, ETC.

Chicago.—The Schoenemann building was destroyed by fire on the 21st inst. Among the firms burned out was the Atlas Electric Company.

Palmer, Mass.—The plant of the Central Massachusetts Electric Company, located at Blanchardville, was almost totally destroyed by fire on the 17th inst. Superintendent E. H. Rollins and Electrician W. E. Shea were badly burned about the hands and face in making their escape from the building. The plant furnished light for all the villages of the town of Palmer, including Thorndike, Bondville, Palmer Center and Three Rivers. It also supplied electricity for lighting purposes for the towns of Monson and Warren. The insurance on the plant amounts to \$30,000. The loss is estimated at about \$50,000.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—On March 24, the Senate passed Senator Brackett's bill, giving the Hudson River Power Transmission Company the power to acquire rights of way in the counties of Saratoga and Schenectady.—On March 25 the Assembly passed Mr. Cowles' bill to incorporate the Electric Water Power Company of Oneonta.

Troy, N. Y.—The furnishing committee of the Court House Commission has awarded the contract for furnishing a system of electric clocks for the new court house to the American Watchman's Time Detector Company of New York, at a cost of \$507. The system is to consist of one master clock and twenty secondary clocks.—The E. G. Bernard Company has received a contract for furnishing the Dobler Brewing Company of Albany two sixty horse power direct-connected generators, one electric elevator, seven direct-connected motors and the necessary apparatus for a lighting plant. It will be the most complete electric plant in this section of the State.

PERSONAL AND MISCELLANEA.

Reuben Franklin Baker, president of the Columbia City Railway of Washington, D. C., died Wednesday last in that city.

S. G. Colman, who has been acting superintendent of the lighting department of the Milwaukee Electric Railway & Light Company since the resignation of William Church, has been appointed to fill the position, and has entered upon his duties. Mr. Colman has been with the company ever since its formation, and was one of the organizers of the old Badger Illuminating Company.

James F. Heyward of Baltimore has completed arrangements for engaging in business in New York as consulting expert of railway companies, capitalists and investors generally. He expects to occupy his office in the Washington Building, No. 1 Broadway, about April 1. Referring to Mr. Heyward's change of location, the Baltimore "Sun" says: "Mr. Heyward's long experience in street railway management would seem to fit him eminently for such work as he intends undertaking. In leaving Baltimore he takes with him the best wishes of his many personal friends for his future success and the gratitude of the thousands whose interests he guarded so faithfully while general manager of the City & Suburban Railway."

The Philadelphia Electrical Exposition Company will give an electrical exhibition in its building, 818 and 820 Chestnut street, Philadelphia, beginning June 6 and continuing for one month. There has been no exhibition given in that city since 1884, and public interest will be aroused by a systematized attempt to place before

it all the progress of electricity since that time. Especial efforts have been made to interest distinguished inventors, such as Edison, Tesla, MacFarlane Moore, Elihu Thomson, Steinmetz and many others. The management has obtained the services of Prof. William D. Marks as director.

The bill to substitute the electric chair for the gallows as a method of capital punishment in Massachusetts has passed the House. The bill also provides that all executions shall take place at the State prison between midnight and sunrise, and carries with it an appropriation for a small building and the necessary appliances.

William Hoffman of Detroit has patented a "composite brake shoe" which is said to be an effective device for "curing" flattened wheels, and which does its work while the car is in regular operation, being carried on the car and easily attached and detached.

A. B. Holmes, a well known electrical inventor and a resident of Newton, Mass., is dead. He was 69 years of age and was a native of Loudon County, Virginia. He was a veteran of the civil war. After the war he turned his attention to the invention of electric lighting appliances and had achieved success in this line of work.

COMMERCIAL PARAGRAPHS.

The Albert & J. M. Anderson Manufacturing Company, of 289-293 A street, South Boston, Mass., well-known makers of Aetna and Hecla railway insulators, switchboards and line material, are said to be extremely busy at the present time turning out switches and switchboards to fill the large number of orders now on hand. This certainly speaks well for the quality of the goods this company is manufacturing.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

At this season of the year the treatment of the dread disease neuralgia is a matter of much consideration. Physicians and people in general have thought that the only permanent cure for neuralgia was a change in climate, water, air and surroundings, and that medical preparations were simply palliative. Neuralgia is in no sense of the word an imaginary disease; the sufferer from this disease is very much aware of the fact, and for this reason the few so-called neuralgia cures, liniments, etc., have been short-lived. The patient very soon discovers their inefficiency. Fortunately, however, there is an institution in Chicago that can and does furnish an effective cure and a sure method of treatment for the cure of neuralgia, which, judging from its rapid growing popularity, will soon take the place of all these palliative treatments. It has certainly made astonishing cures in this obstinate disease, and its merits have made it famous among physicians; and this is known as the Anti-Neuralgic cure, specialized by the French Chemical Company, 356 Dearborn street, Chicago.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The recently patented Newgard Water Proof Receptacle and Globe is finding a large field of usefulness in breweries, paper mills, packing houses, sugar refineries and all other places where moisture or fumes make the insulation of an ordinary lamp socket a difficult proposition. The price of this device is down to a point where it is economy to use it in all places where high insulation is required. The Newgard Receptacle and Globe is so simple in construction and yet so clever in its conception that it commends itself to every one at first sight. The Electric Appliance Company of Chicago are always glad to submit a sample of this globe where there is a possibility of its adoption.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, acts gently and positively on kidneys, liver and bowels, cleansing the entire system, dispels colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

INCORPORATIONS.

The Carbondale Heat & Power Company, Carbondale, Pa. Capital stock, \$100,000.

The United Traction Company, St. Louis. Capital stock, \$2,000. Incorporators: John Scullin, James Campbell and Harry Scullin.

The National Electric Car Lighting Company of West Virginia, capitalized at \$2,000,000, has been licensed to transact business in Illinois with a capital stock of \$2,000.

The Newport Electric Power & Light Company, Newport, Ore. Capital stock, \$3,000. Incorporators: R. A. Bensell, William Matthews and E. Williams.

The Automatic Electric Alarm Company, San Francisco, Cal. Capital stock, \$300,000, with \$50 subscribed. Directors: Arthur C. Donnell, Piedmont; R. B. Woodward, H. D. Walker, Alfred Allayne Jones, Henry P. Dimond, San Francisco.

The Reger & Atwater Company, San Francisco, Cal.—to deal in electrical and mechanical supplies. Capital stock, \$25,000, with \$22,000 subscribed. Directors: A. P. Reger, William M. Reger, C. A. Reger, M. E. Reger and R. D. Duke, all of San Francisco.

The San Gabriel Traction Company, Los Angeles, Cal.—to build an electric railway from Los Angeles to Pasadena, with branches to Duarte, Monrovia and Sierra Madre. Capital stock, \$1,000,000. Directors: James F. Graham and S. P. Anderson, of Chicago, Ill.; Walter Maxwell, Bradner Lee and Albert Hadley, of Los Angeles.

The Littleton Water, Power & Light Company, Littleton, N. J. Capital stock, \$2,000. Incorporators: William B. Hord, A. F. Bennett and Hunter Wykes, all of New York.

The Eastern Electrical Construction Company, Philadelphia—to construct electric plants. Capital stock, \$50,000. Directors: William D. Barnard and Edgar M. Yarnall, Philadelphia; William Hoopes, Baltimore.

The West Oneonta & Laurens Railroad Company, Oneonta, N. Y.—to build and operate an electric railroad connecting West Oneonta and Laurens. Capital stock, \$75,000. Directors: Frank Gould, Parker Wilson, Albert D. Getman, Herbert H. Getman, Walter S. Whipple and Harry W. Lee, of Oneonta, and David S. Peet, Peter Seeber and P. K. Strong, of Laurens.

The Buffalo Valley Railway Company, Buffalo, N. Y.—to operate 27 miles of electric road from Buffalo to Java, Wyoming County, N. Y. Capital stock, \$50,000. Incorporators: Luther S. Bent and Felton Bent, of Philadelphia; Mason D. Pratt and Edgar O. Felton, of Steelton, N. Y.; Herbert P. Bissell and J. Henry Metcalf, of Buffalo; Joseph R. Ford and Frederick W. Wood, of Baltimore; Benjamin Watson, of Stryker, N. Y.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 22, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 630,857. Trolley-Wheel. Austin B. Collett, Lynn, Mass. Filed May 24, 1896.
600,900. Trolley-Wheel. Elbert R. Robinson, Chicago, Ill. Filed Nov. 28, 1896.
603,891. Pneumatic Controlling System for Electric Cars. Sidney H. Short, Cleveland, O. Filed Sept. 20, 1897.
601,206. Brake for Electric-Motor Cars. Patrick R. Hayes and Hugh M. Carbine, Chicago, Ill. Filed Dec. 23, 1896.
601,016. Street-Car Fender. Albert W. Routh, Pittsburgh, Pa. Filed Sept. 25, 1897.
601,131. Car-Fender. Jacob F. Eisenhower, Leighton, Pa. Filed Dec. 20, 1897.
601,155. Car-Fender. Susan F. Moore, Peabody, Mass. Filed Nov. 28, 1896.

ELECTRIC LIGHTS AND APPLIANCES.

- 601,108. Cluster-Fixture for Electric Incandescent Lamps. Nelson Weeks, New York City. Filed Oct. 1, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 600,911. Magnetic-Clutch and Power-Station System. Bion J. Arnold, Chicago, Ill. Filed June 20, 1896.
601,023. Alternating-Current Motor. Walter Langdon-Davies, London, England, assignor to the Davies Motor Company, Limited, same place. Filed Nov. 15, 1897.

MEASURING INSTRUMENTS.

- 600,981, 600,982, 600,983. Electrical Measuring Instruments. Edward Weston, Newark, N. J. Filed Dec. 7, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 600,990. Telephone. George F. Payne, Philadelphia, Pa. Filed Aug. 21, 1897.
600,991. Telephone-Transmitter. George F. Payne and William D. Gharky, Philadelphia, Pa.; said Gharky assignor to said Payne. Filed Sept. 11, 1897.

MISCELLANEOUS.

- 600,866. Electrical Alarm Gage. John Hackney, Norfolk, Va. Filed June 24, 1897.
600,874. Electrical Device for Propelling Boats. Lyman R. Jones, Boston, Mass., assignor to Samuel Jackson and William Potter, Jr., trustees, same place. Filed July 2, 1895.
600,925. Towing Canal-Boats, etc. Thomas S. Miller, South Orange, N. J. Filed Nov. 15, 1895. Renewed Aug. 24, 1897.
600,937. Electric Contact-Box. Joseph N. Thomas, Johnstown, Pa., assignor to the Johnson Company, Lorain, O. Filed Sept. 18, 1897.
600,969. Electric-Circuit-Closing Device. George Newman, El Paso, Tex. Filed Sept. 27, 1897.
601,012. Battery. William Morison, Montclair, N. J. Filed Jan. 20, 1896.
601,172. Portable Camera for Roentgen-Ray Photography. Gaston Seguy, Paris, France. Filed March 23, 1897.
601,115. High-Potential Insulator. John W. Bock, East Liverpool, O., assignor to the R. Thomas & Sons Company, same place. Filed Feb. 1, 1898.
601,222. Drop Signal Apparatus. Oscar A. Danielson, Owatonna, Minn. Filed May 12, 1897.

DESIGNS.

- 24,894. Case for Electrical Measuring Instruments. Edward Weston, Newark, N. J. Filed Feb. 14, 1898.
28,395, 28,396. Electrical-Instrument Case. Edward Weston, Newark, N. J. Filed Dec. 7, 1897.

The Orange County Telephone Co.

The following account of the origin and progress of this successful independent company is taken from a recently issued supplement of the *Daily Times* of Middletown, N. Y.:

"In June, 1895, the question of forming an independent telephone company in Middletown was suggested to our citizens. At that time the Hudson River Telephone Company was charging such a rate that only a comparatively few used the service. Its system was the single wire with ground return circuit. For this it was charging \$48 a year with seventy subscribers in this city. The plan laid before the people by the local organization was to sell one hundred shares of stock at \$100 a share, no one to own more than two shares, and to incorporate for \$10,000.

"When the first meeting of the stockholders was called, April 6, 1895, an organization was effected at once. Soon after a board of directors was chosen and the necessary papers to put in existence the 'Orange County Telephone Company, of Middletown, N. Y.' were made out and sent to the proper authorities at Albany. Rates placing telephones at \$30 a year for business places and \$24 for residences were decided upon, and by the time the stock was all sold over one hundred were secured as subscribers besides the hundred stockholders, who had all taken 'phones.

"At the first meeting of the board of directors, A. B. Wilbur was chosen president, Dr. E. Fancher vice-president; George A. Swalm, Jr., secretary, Frank Harding treasurer, and John L. Wiggins attorney. The board of officers stands the same to-day with the exception of Dr. T. D. Mills, who, on Mr. Wilbur declining to again accept the presidency at the first annual meeting, was elected president. Mr. Wilbur has also been elected vice-president in place of Dr. Fancher, and W. A. Marshall secretary. The board of directors is as follows: Dr. T. D. Mills, C. W. Martin, John L. Wiggins, F. Harding, L. S. Stivers, John E. Iseman, J. J. Silk, Robert C. Tushill, T. A. Weller, W. A. Marshall, Leander Brink, L. V. Sinsbaugh, A. B. Wilbur.

"On July 22, 1895, work was commenced on the construction of the line, the necessary franchise having been granted the new company by the city fathers. It was not until September 7, 1895, that the company really 'got down' to business. At that time Mr. George G. Otis, the present general manager of the company, was placed in charge and from that time on the construction went on in a most systematic manner.

"At present the company stands one of the best independent companies to be found anywhere in the United States.

"The company now has 308 connections. The system used is known as the metallic or common return system on a heavy copper wire which works perfectly. The instruments used were purchased from the American Electric Telephone Company of Kokomo, Ind. They were selected from at least two dozen other makes and were purchased solely on their merits, although costing more than many that were in competition. The switchboards were also purchased of the same company and are most excellent ones.

"General Manager Otis is one of the best electricians in the country, and his wide experience in constructing exchanges, he having built several, greatly aided him in giving our city such a perfect system.

"The company has extended its lines to several neighboring villages and Bloomingburg, Fair Oaks, Circleville, Scotchtown, Phillipsburg and Mechanicstown are now connected with the main office."

The National Telephone Company of Fort Wayne, Ind., at a meeting on the 15th inst., elected the following officers and directors: President, George W. Beers; vice-president, O. H. Corey; secretary, D. J. Cable; treasurer, W. H. Duffield; directors: S. M. Foster, Fort Wayne; C. H. Corey, Lima; W. H. Duffield, Lima; W. L. Parmeter, Lima; D. J. Cable, Lima; Henry C. Paul, Fort Wayne; Charles S. Bash, Fort Wayne; George W. Beers, Fort Wayne; F. W. Holmes, Lima. It was decided to extend the line from Kendallville to Sturgis, Mich., and then to connect with Grand Rapids, Kalamazoo, Lansing, Detroit and a score of intermediate towns of greater or less population. The report of the secretary showed that connections have been made with 175 towns in northeastern Indiana and northwestern Ohio, with a total length of wire of 2,000 miles.

The motion of Senator Brush to discharge the Finance Committee from the further consideration of the bill for cheaper telephone rates in New York having been tabled by a vote of 24 to 13 practically disposes of telephone legislation at this session, as the Finance Committee is apparently friendly to the monopoly.

The city council of Carlyle, Ill., has lately granted two telephone franchises—one to the Central Union Telephone Company, with headquarters at Highland, and the other to the Clinton County Telephone Company, composed of

home capitalists. The former concern will build a long-distance line, while the latter will connect all the towns in Clinton County. The home office will be in Carlyle.

The N. Y. *Herald* says: "Richard Croker has interested himself in a telephone company and has undertaken the task of seeing that it gets the use of the subways for its wires. He has taken an active part in the fight for lower telephone rates which has been going on for years." The company referred to is the American Telephone Company, which has offices in the Townsend building at Broadway and Twenty-fifth street, New York. It has no 'phones of its own in operation and has no connection with the American Telephone & Telegraph Company.

The Mississippi Valley Telephone Company has offered, through its representative, J. E. Craig, of Keokuk, Ia., to pay the expenses of a city election at Omaha, Neb., to vote upon granting it a franchise in Omaha. Its rates are \$48 for business houses and \$24 for residences, and if the franchise is obtained Mr. Craig states that they will begin at once to put in the plant.

A new franchise has been granted by the village board of Fulton, N. Y., to the Fulton Telephone Company, on condition that the company has its system in operation by June 1. The company is the same that applied for a franchise about one year ago under the name of the Automatic Telephone Company.

The borough council of Media, Pa., has granted the Delaware County Telephone Company the privilege of erecting poles and wires in the streets of the borough. The company has a line of poles almost completed between Chester and Media.

Telephone lines are being extended in Sevier County, Tenn. A branch to be known as the Sevierville, Walden's Creek and Wear's Valley line is to be constructed soon. Dr. E. H. Pearce is president, and W. C. Large secretary of the company organized to build the line.

The Pennsboro, W. Va., council has granted a franchise to the Citizens Telephone Company, who will at once put in a large number of 'phones and make connection with other lines passing through Pennsboro.

About twenty independent telephone companies in Iowa have just organized a State Association. The exchange in Des Moines opened with seven hundred subscribers last October, and is now serving twelve hundred.

The city council at Wilmington, Del., has ordered the Bell telephones removed from the city offices. The Delmarvia Company's 'phones are to be used instead.

The People's Telephone Company has made arrangements to extend its line from Romulus to Wayne, Belleville and Maybee, Mich.

A new telegraph line has been completed between Jacksonville, Fla., and Punta Rassa, where connection is made with the cable to Key West and Havana.

New Companies Incorporated.

The People's Telephone Company, Bartlett, O. Capital stock, \$2,000.

The Summit Telephone Company, Summit, Miss. Capital stock, \$10,000.

The Edenton Telephone Company, Edenton, N. C.—to establish and operate a telephone system and an electric light plant. Capital stock, \$1,500. Incorporators: A. T. Bush, George P. Folk, J. W. Branning, W. D. Pruden, E. B. Conger and W. J. Leary, Jr.

The Madison Telephone Company, Belleville, Ill. Capital stock, \$20,000. Incorporators: W. H. Johnston, B. L. Behr, E. W. Lazell and T. H. Wright.

The Tupper Lake Telephone Company—to operate in Franklin and St. Lawrence counties, N. Y. Capital stock, \$1,000. Directors: Nina L. Johnson, E. H. Johnson, Lillian M. Johnson, W. E. La Fountain, Rebecca H. La Fountain, William McLaughlin and Sarah McLaughlin, of Altamont, Franklin County, N. Y.

The New Amsterdam Telegraph & Telephone Company—to operate lines of telegraph and telephone in the several boroughs of New York City. Capital stock, \$100,000. Directors: H. W. Corbin, of Paterson, N. J.; Edward J. Leavy, F. B. Mullaby, Benson F. Currier, James F. Leavy, John J. Healy and A. E. C. King, of New York City.

The West Plains Telephone Company, West Plains, Mo. Capital stock, \$20,000. Incorporators: D. W. Reese, Charles H. Gale, Viola B. Gale, V. M. and F. O. Hines.

The McFall Telephone Company, McFall, Mo. Capital stock, \$1,000. Incorporators: C. O. and H. J. Patton, Lewis Schultz & Co., William A. Patton, Jr., and others.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen. general; g., gold; guar., guaranteed; Inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authorz'd	Issued.				
Albany, N. Y.—Mar. 28:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1 1/2 % Q., Feb. '98.	133 1/2	134 1/2
Troy City Railway Co.	100	2,000,000	1 % Q., Dec. 10, '97.	70	72
Traction Co. (Saratoga)	100	50,000	.....	..	..
Allentown, Pa.—Mar. 28:					
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000 .....	..	80
Bridgeport, Conn.—Mar. 28:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1 % Aug., '97.	45	60
Baltimore, Md.—Mar. 28:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5 % S., July 2, '97.	72	73
Baltimore Consolidated Ry. Co.	25	10,000,000	\$1,777,000 2 % S., Jan. 15, '98.	22 1/4	22 1/2
Central Ry. Co. of Baltimore City	50	800,000	800,000 6 % A. Dec., 1897.	80	82 1/2
Boston, Mass.—Mar. 28:					
New England Street Ry.	25	5,000,000	1,081,925 1 % Q., Jan. 15, '97.	18	20
North Shore Traction Co.	100	4,000,000	4,000,000 .....	..	..
North Shore Traction Co. pfd.	100	2,000,000	2,000,000 6 % S., A. & O.	60	65
West End Street Ry. Co.	50	10,000,000	9,085,000 4 1/2 % S., Oct., '97.	80 1/4	81 1/2
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000 4 % S., Oct. 1, '97.	101	112
Boston Elevated R. R.	100	10,000,000	.....	56 1/2	57 1/2
Brooklyn, N. Y.—Mar. 28:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400 2 % Feb. 1, 1898.	187	..
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	39	89 1/2
*Brooklyn Heights Railroad	....	200,000	200,000 .....	..	..
*Brooklyn City RR.	100	12,000,000	12,000,000 2 1/2 % Q., Jan., '98.	195	199
*Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000 .....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	2,000,000 1 1/2 % Oct. 1, '97.	150	180
Kings County Elevated	100	4,750,000	4,750,000 .....	..	..
Kings County Traction Co.	100	4,500,000	4,500,000 1 1/2 % July 26, '97	45	50
Nassau Electric Railroad	100	6,000,000	6,000,000	40	..
*Atlantic Avenue Railroad	50	2,000,000	2,000,000 .....	..	..
*Brooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	74	80
Buffalo, N. Y.—Mar. 28:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	62	65
*Buffalo Railway Co.	100	6,000,000	5,370,500 1 % Q. Dec., '97.	78	81
Columbus, O.—Mar. 28:					
Columbus Street Railroad	100	8,000,000	8,000,000 1 % Q., Feb., '98.	42	46
Columbus Central Street Railroad	100	1,500,000	1,500,000 .....	..	..
Charleston, S. C.—Mar. 28:					
Charleston City Ry. Co.	50	100,000	100,000 3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000 .....	..	..
Chicago, Ill.—Mar. 28:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 3 % Q., Dec. 31, '97.	228	231
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	11	..
Lake Street Elevated RR.	100	10,000,000	10,000,000 .....	..	..
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000 .....	..	4
Met. West Side El. const. stk.	100	15,000,000	2,500,000 .....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000 8 % Q., Jan., '98.	213	216
North Chicago City RR.	100	500,000	249,900 .....	..	..
South Chicago City Railway	100	2,000,000	1,603,200 .....	..	..
(West Chicago St. RR. Co.)	100	20,000,000	13,189,000 1 1/2 % Q., Feb., '98.	91	92 1/2
*Chicago West Div. Ry.	....	1,250,000	624,900 35 % .....	..	..
*Chicago Passenger Ry.	100	2,000,000	2,000,000 5 % S.	..	..
Cincinnati, Ohio.—Mar. 28:					
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000 .....	..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000 2 1/2 % S., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	23	25
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000 1 1/2 % Q., Jan., '98.	115 1/4	116
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1 1/2 % Q., Jan., '98.	..	..
Cleveland, Ohio.—Mar. 28:					
Arnon, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000 3/4 % Jan., '98.	41	43
Cleveland City Ry.	100	8,000,000	7,600,000 3/4 % S., Oct., '97.	59	61
Cleveland Electric Ry.	100	12,000,000	12,000,000 3/4 % Q., Oct., '97.	60 1/2	61
Detroit, Mich.—Mar. 28:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100 1/2	..
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000 5 % July, '96.	175	..
Rapid Railway Co.	100	250,000	250,000 .....	..	100
Detroit Electric Railway	100	1,000,000	1,000,000 .....	..	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton, O.—Mar. 28:					
City Railway Co.	100	1,500,000	1,470,600 1 1/2 % Q., Jan. 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000 1 1/2 % Q., Jan. 1, '98.	140	145
People's Street Railway	100	1,100,000	.....	110	..

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Walkbrook, Gwynn Oak & Powhatan Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad, Co., which guarantees 10 % on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$200 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$200,100 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k \$50 per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$225,100 of stock owned by West Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authorz'd	Issued.				
Hartford Conn.—Mar. 28:					
Hartford Street Ry. Co.	100	\$4,300,000	\$200,000 3 % S., Jan., '98.	140	..
Hartford & West Hartford RR.	100	1,000,000	247,000 .....	..	..
Holyoke Mass.—Mar. 28:					
Holyoke Street Ry. Co.	100	400,000	400,000 8 % A., Jan., '98.	200	206
Hoboken, N. J.—Mar. 28:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8 %, 1892.	70	..
Indianapolis, Ind.—Mar. 28:					
*Citizens' Passenger Ry.	....	5,000,000	5,000,000	24	25
Lancaster, Pa.—Mar. 28:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000 .....	..	..
Lancaster & Col. Electric Ry.	....	87,500	.....	..	..
West End Street Railway	....	.....	.....	..	..
Louisville, Ky.—Mar. 28:					
Louisville Ry.	100	4,000,000	3,500,000 1 1/4 % S., Oct., '97.	35	38
Louisville Ry. 5 % pfd.	100	2,500,000	2,500,000 2 1/2 % S., Oct. 1, '97.	95	100
Minneapolis, Minn.—Mar. 28:					
Twin City Rapid Transit	100	17,000,000	15,010,000	20	24
Twin City Rapid Transit 7 % pfd.	....	8,000,000	1,714,200 1 1/4 % Jan., '98.	..	100
Montreal, Canada.—Mar. 28:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8 % S., M. & N.	251 1/2	254
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1 1/4 % S., J. & J.	92 1/2	92 3/4
Memphis, Tenn.—Mar. 28:					
Memphis Street Railway Co.	100	500,000	500,000	15	..
New Haven, Conn.—Mar. 28:					
Fair Haven & Westville RR.	25	1,500,000	900,000 4 % S., Sept., '97.	57	60
New Haven Street Railway Co.	100	1,250,000	1,000,000 2 1/2 % A., July '96.	60	80
New Haven & Centerville RR.	100	700,000	300,000 .....	..	..
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—Mar. 28:					
Canal & Claiborne RR. Co.	40	240,000	240,000 1 % S., Jan., '98.	140	158
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1 1/2 % Q., Jan., '98.	122 1/4	124
New Orleans Traction Co.	100	5,000,000	5,000,000	2	5
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	9	15
crescent City RR.	100	2,000,000	2,000,000 3 % S., Jan., '98.	..	62
b New Or. City & Lake RR.	100	2,000,000	2,000,000 4 % S., Jan., '98.	82	..
Orleans Railroad	50	500,000	185,000 1 1/2 % S., June, '94.	16	21
St. Charles Street Railway	50	1,000,000	1,000,000 1 1/2 % S., Jan., '98.	54 1/2	55 1/2
New York—Mar. 28:					
Central Crosstown RR.	100	600,000	600,000 2 % Q., July, '97.	200	..
c Christopher & 10th Sts. RR.	100	650,000	650,000 2 % Q., Jan., '98.	154	164
Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000 1 1/2 % Q., Feb., '98.	180	186
d Metropolitan Street Ry. Co.	100	30,000,000	30,000,000 1 1/4 % Q., Jan., '98.	131 1/2	139
e Bleeker St. & Fulton Ry. Co.	100	900,000	900,000 2 1/2 % A., July, '97.	32 1/2	85
f Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2 1/2 % Q., Oct., '97.	205	..
g Cen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2 1/4 % Q., Jan., '98.	173	180
h Eighth Avenue RR.	100	1,000,000	1,000,000	310	330
i 42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2 % Q., Feb., '98.	320	340
j Ninth Avenue RR.	100	800,000	800,000	180	..
k Sixth Avenue RR.	100	2,000,000	2,000,000	192	..
l Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4 1/2 % Q., Feb., '98.	900	825
m Second Avenue RR.	100	2,500,000	1,862,000 2 % Q., Jan., '98.	165	..
n Third Avenue RR.	100	12,000,000	10,000,000 2 % Q., Feb., '98.	167 1/2	..
o 42d St. Manhatn. & St. Nich. Av.	100	2,500,000	2,500,000	65	74
p Union (Huck) Ry.	100	2,000,000	2,000,000	175	200
Newark, N. J.—Mar. 28:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	46	50
Newark Passenger Ry.	100	6,000,000	6,000,000 .....	..	..
n Rapid Transit Street Ry.	100	504,000	504,000 1 1/4 % A.	185	195
Pittsburg, Pa.—Mar. 28:					
Allegheny Traction Co.	50	500,000	500,000 .....	..	45
o Consolidated Traction Co.	50	15,000,000	15,000,000 2 % Jan., '95.	133 1/2	134
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000 3 % May, '97.	46 1/2	47
p Central Traction Co.	50	1,500,000	900,000 .....	..	..
q Citizens' Traction Co.	50	8,000,000	3,000,000 6 % A.	61 1/2	..
r Duquesne Traction Co.	50	8,000,000	3,000,000 6 % A.	..	..
s Pittsburg Traction Co.	50	2,500,000	1,900,000 3 % Aug., '95.	..	..
t Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000 2 1/2 % Jan., '98.	..	21 1/4
u Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	2,994,839 2 % Aug., '95.	153 1/2	..
v Pittsburg & Birmingham Trac. Ry.	25	8,000,000	3,000,000 2 % Jan., '96.	153 1/2	159 1/2
w Pittsburg & West End Ry.	50	1,500,000	1,500,000 5 % A., June 30, '97.	..	..
x Second Avenue Traction Co.	50	4,000,000	14,000,000 .....	..	..
y Suburban Rapid Transit Co.	50	300,000	200,000 .....	..	..

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 7 % first 5 years, 8 % thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—Mar. 28:							Boston, Mass.—Mar. 28:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/4% Q. Jan. '98.	...	250
Northampton, Mass.—Mar. 28:							New England Telephone Co.....						
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175	...	100	10,894,600	10,804,600	\$1.50, Feb. '98.	120 1/2	124
Omaha, Neb.—Mar. 21:							New York.—Mar. 28:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2% Q.	...	90
Paterson, N. J.—Mar. 28:							*Central & South Am. Tel. Co.....						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	6,500,000	6,500,000	1 1/2% Q.	104	106
Providence, R. I.—Mar. 28:							Franklin Tel. Co..... 2 1/2% guar.						
United Traction & Electric Co.....	100	8,000,000	8,000,000	3/4% Jan. '98.	59	62	Eric Telephone & Telephone Co.....	100	1,000,000	1,000,000	1 1/2% S.	188	189
Philadelphia.—Mar. 28:							*Gold & Stock Tel. Co. guar. 6%						
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14 1/2	..	*International Ocean Tel. Co. guar. 6%	100	5,000,000	4,800,000	1 1/2% Q. Jan., '98.	40	40 1/2
Hestonville, Man. & Fairmount.....	50	1,965,100	1,965,100	2 1/2% Jan. 15, '97.	44	45	Mexican Telephone Co.....	100	5,000,000	.....	1 1/2% Q.	107 1/2	110
Hestonville, Man. & Fairmount.....	50	533,900	533,900	3% S.—Jan. 10, '98.	61 1/2	65	*New York & New Jersey Tel. Co.	100	8,000,000	.....	1 1/2% Q.	106	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. guar. 4%	100	2,000,000	.....	2% S.	6	70
Union Traction Co. \$12 1/2 pd.	50	30,000,000	21,930,400	.....	15 1/2	15 1/2	*Postal Telegraph Cable Co.....	25	5,000,000	8,728,000	1 1/2% Q. Jan., '98.	143	145
Electric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5%	100	15,000,000	15,000,000	1 1/2% Q.	...	..
City of Philadelphia Passenger Ry.....	50	500,000	1192,500	\$3 share Q.	30 1/2	30 1/2	*Commercial Union Telegraph Co.	25	950,000	559,525	2 1/2% S.	87	90
Frankford & Southwark Pass. Ry.	50	1,000,000	1,875,000	\$14 share A.—Apr. 97	47	..	Western Union Telegraph Co.....	25	500,000	500,000	8% S., Jan. 1 '98	112 1/2	113 1/2
Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	89	90 1/2	Div. guar. by Postal Tel. Co.	..	97,870,000	.....	1 1/2% Jan., '98	86	86 1/2
Lombard & South Street Ry.....	25	1,000,000	1,000,000	A. & O.	89	..	Miscellaneous.—Mar. 28:						
Second & Third Streets Ry.....	50	1,000,000	1,000,000	.....	89	..	American Dist. Tel. (Phila.).....	25	400,000	.....	1% Q., Feb. '98.	14	..
People's Traction Co.....	50	10,000,000	16,000,000	3% A., April, '97.	135	..	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2 1/2% S.	178	176
Germanstown Passenger Ry.....	50	1,500,000	1,500,000	.....	135	..	Chesapeake & Potomac Tel. Co....	100	.....	.....	.....	20	55
Green & Coates Passenger Ry.....	50	500,000	152,800	\$5.25 share—1898.	132	..	Chicago Telephone Co.....	100	.....	.....	.....	202	..
People's Passenger Ry..... com.	25	1,500,000	115,000	3% Jan., 1898.	132	..	Central Dist. Prtg. & Tel. Co. (Phg.)	100	750,000	750,000	.....	64	78
People's Passenger Ry..... pfd.	25	750,000	1740,000	.....	..	..	Empire & Bay States Telegraph Co.	100	.....	.....	.....	74 1/2	80
Philadelphia Traction Co.....	50	30,000,000	120,000,000	4% S.—Oct. 1 '97.	79 1/2	80	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	112	117
Catherine & Bainbridge Sts.....	50	1,000,000	1,400,000	6% A.—Mar. '97.	185	145	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2% Q.	87 1/2	..
Continental Pass. Ry. guar.	50	1,000,000	1,500,000	\$6 share—July, '97.	185	145	Providence (R. I.) Tel. Co.....	50	.....	.....	.....	130	122
Empire Passenger Ry. Co.....	50	600,000	600,000	.....	180	180	Southern New Eng. Tel. Co.....	100	8,000,000	.....	.....	..	..
Philadelphia City Pass. Ry.....	50	1,000,000	1,475,000	\$7.50 share July '97	178 1/2	..	ELECTRIC LIGHT AND ELECTRICAL MFG. COS.						
Philadelphia & Gray's Ry. RR.	50	1,000,000	298,650	\$8.50 share July '97	86	..	Boston, Mass.—Mar. 28:						
Ridge Avenue Passenger Ry.....	50	750,000	1,420,000	\$12 share, July '97	262	..	Fort Wayne Electric Co.....	..	.....	.....	.....	..	..
Philadelphia & Darby Ry. guar.	50	.....	1,200,000	\$2 share July '97	157 1/2	..	Pt. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	..	..
17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	1,250,000	1 1/2% S., July, '97	270	..	General Electric Co. com.	100	40,000,000	80,460,000	2% Q., Aug. 1898.	32 1/2	33 1/2
Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	1,900,000	\$11 sh. A., July, '97	227	228	General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	91	91
Union Passenger Ry. Co.....	50	1,500,000	1,900,000	\$9.50 sh. A., July '97	227	228	T. H. Elec. Co. T. Secur., Series D.	100	.....	.....	.....	8 1/2	8 1/2
West Philadelphia Pass. Ry.....	50	750,000	1,750,000	\$10 share, July '97	225	235	Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	21	2 1/2
Rochester, N. Y.—Mar. 28:							Westinghouse El. & Mfg. Co. pfd.						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	17	20	Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	..	..
Reading, Pa.—Mar. 28:							New York.—Mar. 28:						
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	123 1/2	125
City Passenger Ry.....	50	850,000	850,000	Jan., '98.	111	..	*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	8,750,000	1 1/2% Oct., '97.	103	108
East Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..	Edison Ore Milling Co.....	100	.....	.....	.....	..	..
St. Louis Mo.—Mar. 28:							Edison Electric Storage Co.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..	General Electric Co. com.	100	40,000,000	80,460,000	2% Q., Aug. 1898.	32 1/2	33 1/2
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1898.	..	..	General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	91	91
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% Jan., '98.	120	122	Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	..
National Railway Co.....	..	2,500,000	2,479,000	1 1/2% Jan., '98.	..	..	United Elec. Lt. & Pow. Co. pfd.	..	.....	.....	.....	..	..
Cass Avenue & Fair Grounds.....	..	2,500,000	2,500,000	.....	..	..	Pittsburg, Pa.—Mar. 28:						
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	..
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% Jan., '98.	95	105	East End Electric Light Co.....	50	800,000	800,000	Q.	..	10
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% Jan., '98.	170	172 1/2	Philadelphia, Pa.—Mar. 28:						
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	..	..	Edison Electric Light Co.....	100	2,000,000	.....	144 1/2	..	
Southern Electric Ry..... com.	50	500,000	500,000	.....	50	52 1/2	*Electric Storage Battery Co. com.	100	8,500,000	.....	21 1/2	12	
Southern Electric Ry. 6% pfd.	100	1,000,000	1,000,000	1 1/2% Jan., '98.	100	102 1/2	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	23	24	
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	53	55	*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97	..	..
Union Depot RR.....	100	4,000,000	4,000,000	8% A., July, '98.	..	175	*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000	.....	6% Oct., '97.	..	..
San Francisco, Cal.—Mar.							Northern Elec. Light & Power Co..						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	107 1/2	109	Southern Elec. Light & Power Co..	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	13 1/2	14
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	..	187,500	187,500	.....	10	..	
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	53 1/2	..	Miscellaneous.—Mar. 28:						
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	10	Brush Electric Co.....	50	.....	.....	.....	..	..
Scranton, Pa.—Mar. 28:							Bridgeport (Conn.) Elec. Lt. Co....						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12	Edison Ill'g Co. (St. Louis).....	25	500,000	.....	.....	37	..
Scranton & Carbondale Trac. Co.	100	500,000	500,000	.....	..	18	Eddy Electric Mfg. Co.....	25	.....	.....	.....	..	..
Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	9	11	Hartford (Conn.) Elec. Light Co....	100	850,000	.....	.....	15	..
Springfield Ill.—Mar. 28:							Hartford (Conn.) Lt. & Power Co....						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11	New Haven (Conn.) Elec. Lt. Co....	100	175,000	.....	.....	45	10
Springfield O.—Mar. 28:							Narragansett (Prov. R.I.) Elec. Co.						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2	Rhode Island Elec. Protec. Co.....	50	1,200,000	.....	2% Q., Oct., '96.	18	..
Springfield, Mass.—Mar. 28:							Royal Elec. Co. (Montreal).....						
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	206	210	Toronto (Canada) Elec. Light Co....	100	1,000,000	.....	2% Q.	11	119
Toronto Canada.—Mar. 28:							Toronto (Canada) Elec. Light Co....						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	92 1/4	92 1/4	Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	1 1/2% Q.	11	119
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	251 1/4	254	Woonsocket (R. I.) Electric Co.....	100	.....	.....	1% S., Dec. 1, '96.	90	100
Washington, D. C.—Mar. 28:							ALLIED INDUSTRIES.						
Belt Ry. Co.....	50	500,000	500,000										

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Mar. 28 1898.						
The Albany Ry.....1st mtg. 5s.	....	\$29,000	1905	J. ....	....	....
The Albany Ry. Co.....Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*111	....
The Albany Ry. Co.....Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
Watervliet Turnpike & RR.1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	....
Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co.....1st 5s	....	....	.....	.....	*103¼	106½
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.						
Date of Quotation—Mar. 28, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Ext. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	105	107
Bal. Trac. Co. No. Balto. div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	116	.....
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	19 0	J. & J.	101½	.....
Baltimore Traction Co. Convertible 5s.	800,000	.....	19 6	N. & M.	103½	.....
Central Pass. Ry. Co. 1st mtg. 6s	96,000	117,000	1912	J. & J.	112	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	804,000	580,000	1922	M. & N.	112	.....
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	116
Lake Roland Elev. 1st mtg. 6s.	1,000,000	1,000,000	1942	M. & S.	111	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119¾	121

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
 ‡\$151,000 in escrow to retire 1st mtg. bds.

Boston, Mass.						
Date of Quotation—Mar. 28, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	162	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	.....

Charleston S. C.						
Date of Quotation—Mar. 28, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....

Chicago Ill.						
Date of Quotation—Mar. 28, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	103¾	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103¾	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	.....	55
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	51½	52
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	101½	.....
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103½	.....
West Chicago St. RR. 1st mtg. 6s.	4,100,000	3,969,000	1928	M. & N.	101½	105½
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	94½	94½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	101½	.....

Cincinnati, O.						
Date of Quotation—Mar. 28, 1898.						
Cin. New & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Eden Pk In. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	107½	107½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	118½	120½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	126½	.....

Cleveland, O.						
Date of Quotation—Mar. 28, 1898.						
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,000,000	1,249,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & S.	108½	107½
East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106½	107½
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	90	95
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co. Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....

Detroit, Mich.						
Date of Quotation—Mar. 28, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	.....	99
Fl. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	.....	A. & O.	.....	99½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	98½	99½

New Haven, Conn.						
Date of Quotation—Mar. 28, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	915	M. & S.	104	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	104	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1905	M. & N.	102	.....

New Orleans La.						
Date of Quotation—Mar. 21, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	72¼	.....
New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1908	J. & D.	108	110
N. Orleans City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	108	.....
Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	91½	99
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	103	.....

New York.						
Date of Quotation—Mar. 28, 1898.						
Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	.....
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	104	107
Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	106½	110
Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122	123
Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	108
Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112
Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*116	.....
Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	115
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	116
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	83	85
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	.....
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,800,000	1941	J. & J.	105½	108
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Brooklyn Rapid Transit. gold 5s.	700,000	5,141,000	1945	.....	93	94
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	105	105
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	101	105
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,100,000	1,100,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. scrip 5 s.	1,000,000	1,000,000	1914	F. & A.	100	*101
Eighth Av. RR. Co. Cert. Indeb. 6 s.	1,200,000	1,200,000	1910	M. & S.	116	.....
12d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,500,000	1,500,000	1915	J. & J.	90	96
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	121	.....
Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,501,000	1,500,000	1937	F. & A.	108¾	.....
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	101	105
Steinway Ry. (L. I.) 1st mtg. g. 5s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123½	125
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	.....
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105

Toronto Canada.						
Date of Quotation—Mar. 28, 1898.						
Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	.....	.....
Toronto St. Ry. 1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	.....	.....

Philadelphia.

Date of Quotation—Mar. 28, 1898

Continental Pass. Ry.....1st mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry.....1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
ombard & So. St. Pass. Ry.....1st mtg. 6s	150,000	.....	1901	.....	....	....
ople's Pass. Ry.....1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
ople's Pass. Ry.....2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
ople's Pass. Ry.....Stk. trs. cert. g. 4s	1,125,000	367,000	1912	M. & S.	....	....
hila. City Passenger Ry.....1st mtg. 5s	5,698,210	.....	1948	.....	102	.....
hildelphalia Trac. Co.....Coll. tr. g. 4s	200,000	200,000	1910	J. & J.	....	....
hirdteenth & 15th St. Ry.....1st mtg. 6s	1,800,000	1,018,000	1917	F. & A	104	105
nirthon Passenger Ry.....1st mtg. 5s	100,000	100,000	1903	A. & O	....	....
nion Traction Co.....Coll. tr. g. 4s	500,000	500,000	1911	A. & O.	....	....
st End Passenger Ry.....1st mtg. 6s	29,735,000	29,724,876	1945	A. & O.	....	....
est Phila. Pass. Ry.....1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115 ³ / ₄	.....
est. Phila. Pass. Ry.....2d mtg. 5s.	750,000	750,000	1926	M. & N.	114 ³ / ₄	115

2 The trust certificates were issued to pay for the shares of the Electric and People's Traction Lines purchased.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Mar. 28, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1906	M. & N.	101	103
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	103½	107½
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	100	102
St. Louis & E. St. L. Electric.....1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	1909	M. & N.	60	64
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	112½	113½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Mar., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferry & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	116	....
Geary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	102	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126	129½
†Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
†Omni-bus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	123	.....
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	109½
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	122
†utter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Mar. 18, 1898.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	50	65
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	120	....
Eckington & Soldiers' Home.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	120	122
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Mar. 28, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102	104
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	110
†Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	70	75
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry.....1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
†Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	105½	106
†Crosst'n St. Ry. (Colu.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	95	98
†Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	93	97
†Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	93	97
†Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	113	113½
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	92	94
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	102	104
†No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	102	104
†No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	118	.....
†Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108½	109
†Rochester (N. Y.) Ry.....1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	99
†St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
†St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'vd to redeem prior liens.						
††\$620,000 in escrow.						
*With interest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Mar. 23, 1898.						
Edison Elec. Illuminating Co., Boston.....	2,026,000	.....	Quar.	154	.....	.....
General Electric Co., gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	100½	.....
Pittsburg, Pa.						
Date of Quotation—Mar. 18, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Mar. 23, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,176,000	1908	.....	114½	.....
Edison Elec. Ilig. Co. (Brooklyn) 4s.	2,500,000	1,500,000	1946	.....	111	112
Edison Electric Light (Philadelphia) 4s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 4s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1908	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 4s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Mar. 28, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph.....7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	103½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Mar. 23, 1898.						
American Electric Heating.....5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. ....	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. ....	.....	.....	1942	J. & J.	95	100
Casborundum Mfg. Co. ....	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co.	75,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 12c.; cast, 11½c.

The Boston Electric Light Company has declared its regular quarterly dividend of 1½ per cent., payable April 15 to stock of record March 31.

The New England Telephone & Telegraph Company has declared a quarterly dividend of 1½ per cent., payable May 14 to stock of record March 31.

A quarterly dividend of three-fourths of 1 per cent., payable April 10, has been declared by the directors of the Cleveland City Railway Company.

The Edison Electric Illuminating Company of New York has declared a quarterly dividend of 1½ per cent., payable May 2 to stock of record April 18.

The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1½ per cent. on its preferred stock, payable April 1.

The Edison Electric Illuminating Company of Brooklyn has declared its regular quarterly dividend of 1½ per cent., payable April 15 to stock of record March 31.

The Columbia & Maryland Railway was purchased at public auction on the 25th inst. for \$450,000 by N. P. Bond, president of the Baltimore Security & Trading Company.

It is understood that the Third Avenue Railroad Company, New York, proposes to declare a stock dividend of 100 per cent. to form the basis for an increase in its bonded indebtedness.

The Safety Insulated Wire & Cable Company of New York has received a contract from the Government for submarine and underground cables connecting all the forts and islands of New York harbor.

The Metropolitan Street Railway Company, New York, has declared a dividend of 1½ per cent. per share, payable April 15 to stockholders of record March 26. Transfer books, closed on March 26, will be reopened April 18.

The Cataract General Electric Company of New York City, which was incorporated in 1893 for a period of five years, has filed in the office of the Secretary of State a certificate of continuation for five years from November 3, 1898.

The directors of the Louisville City Railway Company, contrary to expectation, have declared the usual 2½ per cent. semi-annual dividend on the preferred stock, and the regular 1½ per cent. semi-annual dividend on the common.

The directors of the Los Angeles Electric Company have decided to call a meeting of stockholders on the 18th of May at Los Angeles, Cal., to vote upon the question of increasing the capital stock of the company from \$300,000 to \$600,000.

Among the bills passed by the New York Assembly last week was Mr. Kelly's, providing that on or before January 1 next every street surface railroad company whose cars are run by electricity or cable, in every city of over 60,000 inhabitants, shall equip its cars with a feeder to be approved by the State Railroad Commission.

The annual meeting of the Amsterdam Electric Light, Heat & Power Company will be held at the office of the company, 84 Broadway, Brooklyn, on Tuesday, April 5, for the purpose of electing seven directors. The transfer books will reopen on April 6.

Senator Cantor has introduced a bill in the New York Senate authorizing street railroad companies to sell lost property found on cars and unclaimed for three months, and to pay the proceeds to an association having for its object financial assistance to its members in case of sickness or accident.

The Welsbach has won its suit against the Sunlight Incandescent Company. The latter claimed invalidity for lack of invention and denial of infringement, insisting that the patent of the Welsbach could not be infringed by the use of any materials other than those specified in plaintiff's patent.

The Cities Senate Committee lacked one vote to report favorably the Ellsworth bill legislating out of office the Rapid Transit Commission of New York and empowering Mayor Van Wyck to appoint a bi-partisan commission. This vote settles the question of a new Rapid Transit Commission this year.

On and after April 1 the Old Colony Trust Company will act as transfer agent, and the American Loan & Trust Company as agent to register transfers of the stock of the Edison Electric Illuminating Company of Boston. In order to complete the arrangement the stock books will be closed from March 30 to April 4.

The stockholders of the Shelby Electric Company of Shelby, O., have decided to increase the capital stock of the plant from \$100,000 to \$250,000. The factory will be doubled and the work of construction is to begin at once.

The New Jersey Legislature has passed the bill allowing the reinstatement of corporations whose charters have lapsed by reason of non-payment of taxes, on making proper representations to the Governor. The bill is believed to be in favor of the Electro-Pneumatic Company.

The Chicago Electric Traction Company has taken possession of and is now operating the storage battery road formerly known as the Englewood & Chicago. The new company will issue \$270,000 of first mortgage bonds, which will go to the holders of the old Englewood & Chicago bonds at par in proportion to their old holdings and \$900,000 (roundly) of consolidated mortgage bonds and \$1,500,000 in common stock.

The Denver, Col., "Post" of the 22d inst. has the following item: "Louis Enricht and Paul Hirsch were arrested at the Brown Palace Hotel this afternoon by Under Sheriff Perry A. Clay on a message from Sheriff W. L. Hawkins of Canon City. Enricht and Hirsch are the promoters of the Canon City & Cripple Creek Electric Railway Company, and are arrested on a charge of conspiracy to obtain money under false pretences."

The New York "News Bureau" says: "The Edison Jr. Incandescent Light Company is negotiating for a location for its proposed new manufacturing plant at Niagara Falls. It can obtain power there at the rate of \$10 per horse-power per year, whereas ordinary steam power would cost it from \$60 to \$90 per year per horse-power. It proposes to erect a plant within the next four months with a capacity for an output of 20,000 lamps per week, and intends also to establish an independent glass plant for the manufacture of incandescent lamp bulbs. It is estimated that the present consumption of incandescent lamps amounts to 120,000 a week in the United States. Officers of the company state that the offer of \$250,000 of the preferred stock of the company for public subscription is meeting with a ready response and the prospects are that the entire amount will be fully subscribed for within a very few days."

Messrs. Spencer Trask & Co. have issued for distribution a handsome little pamphlet, entitled "The Edison Electric Illuminating Companies of Greater New York," reviewing from the investor's standpoint those splendid properties, and containing an exhaustive resume of their management and operation since their origin to the present day. The book, which is prepared in a way to interest the general reader as well as those financially interested in the companies, has tables showing the gross and net earnings of the companies for several years, the expansion of business, growth of capital, and much other information, and has fine pictures of the central station of the Edison Electric Illuminating Company of New York and the Pearl street central station of the Edison Electric Company of Brooklyn. A folding map of part of New York City, showing the underground mains of the New York company is appended.

ESTORS.
lytic, 1140114e. la
ared its regular
March 31.
company has de
of record March 11.
cent, payable Apr
ilway Company.
New York has de
of record April
Company has de
able April 1.
Brooklyn has de
to stock of re
used at public
Baltimore Sec
Company, New
the basis for an

New York has
ground cable
York, has de
holders of r
April 15.
York City, wh
office of the
umber 3, 1898.
ony, contrary
depend on the
the common.
y have decid
Cal. to vote
om \$300,000
last week w
et surface n
of over 10
e State Bar
ght, Heat &
ilway, Brook
be transfer

rk Senate
rs and un
ing for its
ht Incas
denial of
tringed
ort favor
on of New
ommission
r.
will act in
ster trans
In order
to April
Shelby, 0
250,000. Th
e.
owing the
not-patent
is becau
possessio
Engaged
nds, when
proposed
bonds and
ollowing
Howe, 18
W. L. Har
on City
of cons

ELECTRICITY.

Vol. XIV.

NEW YORK, APRIL 6, 1898.

No. 13.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:	
UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:
As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	193 194
A New Electric Conduit System.	
Amendments to Patent Laws.	
Searchlights.	
Wave and Tide Motors.	
Under the Searchlight,	194
War on the General Electric.	
Electrical Exhibition Notes,	195
Communication—The Firman Patent,	195
Electricity in Coal Pits,	195
Electric Progress in Corea,	195
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XVII—The Hermite Bleaching and Disinfecting Processes. By J. B. C. Kershaw, F. I. C.,	196
Insulation and Conduction. By Reginald A. Fessenden,	197
Biography of a Piece of Copper Wire. By Channing T. Gage,	199
New System of Electric Traction by Alternating and Direct Currents. By C. Jorignot. (Translation),	200
The Northwestern Electrical Association,	200
London Notes,	201
Congressional Notes,	201
Proposals Invited for Electric Elevators,	201
Legal Notes,	201
The News,	202
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Commercial Paragraphs,	203
Incorporations,	204
Electrical Patent Record,	204
Telephone and Telegraph,	204
Electrical Securities—Stocks, Bonds, Etc.,	205
Notes for Investors,	208

EDITORIAL NOTES.

A New Electric Conduit System.

Numerous conduit electric railway systems have been invented from time to time, and several are now in operation in some of our large cities. In looking over the systems brought out it would certainly seem as if almost every conceivable arrangement of apparatus had been thought of and the field in this line most thoroughly covered. Such, however, appears not to be the case, as we now hear of a rather ingenious system suggested by a Chicago man. The conduit systems so far patented—several hundred in number—may be divided roughly into three classes: those having an open or slotted conduit, those having a semi-open or closed conduit, and those having a sealed conduit. The system referred to above and invented by the "Windy City" man belongs to that of the second class. It is said to work on practically the same principle as electric arc lights. There is necessarily a conduit, but quite shallow, sixteen inches in depth by four inches in width. In the pavement on each side of the slot are located two castings twenty feet apart. The ends of the castings nearest the rail are connected by an electric conductor located either underneath or close by the rail. Through the center of the castings a large circular hole is bored at right angles to the line of the track. Within this aperture a movable brass cylinder is located and within the cylinder is placed a heavily insulated metal rod. On the end of the latter, which extends into the conduit, is an ordinary trolley wheel. The movable brass cylinder is provided with two springs which tend to move it forward and away from the charged conductor. Each car is equipped with a wedge-shaped plow, twenty-one feet in length, which, when the vehicle is in motion, strikes between two opposite pulleys, one positive the other negative, and presses them back against the action of the springs. In this manner connection is made with the line conductors situated under each rail. The current then passes through the insulated metal rod and by means of the trolley wheel to the plow on the car and from there to the motors, the negative current passing out in the same manner on the opposite side. As the plow on a car is slightly longer than the distance between the switch boxes, the front of the plow reaches the next set of pulleys before it leaves the rear set, thus insuring a continuous flow of current through the motors. In other words, in this system the general arrangement is the reverse of that usually met with, the long plow on the car in reality taking the place of the continuous conductor. The inventor claims that his system is a great improvement over the various designs heretofore brought out, there being no current in the conduit except where the car happens to be,

and the end of the rod where it is pushed in to receive the current being in an air-tight space where no water or moisture can gain access.

It is claimed that a system as described above can be constructed for \$25,000 a single track mile, or for about one-third what the cable costs, owing in part to the shallowness of the conduit. The inventor is endeavoring, so it is said, to get his system adopted by some of the roads in Chicago.

* * *

Amendment to Patent Laws.

The following important amendment to the Patent Laws was recently introduced in the United States Senate by Senator Hanna: "That in cases of infringement or alleged infringement by purchasers or users of any patented device whatever, any individual, company, or corporation, to establish their claims upon patents of said devices, shall, in the courts having jurisdiction, enter suit against said purchaser or user within the space of five years from the date of the first alleged infringement by said purchaser or user or be forever debarred from collecting royalty or damage for the use of said device, to the end that the purchaser shall become the owner in reality as well as in name and not be further molested."

"That any individual, company or corporation owning or controlling patents acquired by purchase or otherwise, in case of alleged infringement by any inventor or manufacturer of any device whatever, to establish their claim of infringement on such device shall, in the courts having jurisdiction, enter suit within the space of one year from the date of said infringement, or be forever debarred from collecting damage from said inventor or manufacturer, though this act shall not be so construed as to debar any individual, company or corporation from establishing their ownership to patents upon said device thus manufactured."

"That any laws conflicting with the above conditions are hereby repealed and declared null and void, and this act shall become a law on and after its passage."

The reasons offered for the presentation of this bill are that there exists at present an abuse of the rights and privileges granted to owners of patents, which has become widespread and is causing great inconvenience and unnecessary expense to innocent purchasers of devices upon which two or more individuals, companies, or corporations claim patents. These claims are said to be often made through the use of telegrams, circulars, pamphlets, letters and advertisements, threatening and intimidating purchasers of such devices, the intimidation sometimes extending over months and years. In a majority of cases it is contended that the cost of defense of the purchaser's rights would be far in excess of amounts claimed, and in these cases settlements are

forced to be made before claims have been thoroughly established. It is therefore contended that such a bill will give ample time to recognize the rights of inventors and yet protect purchasers from great inconvenience and loss, such as is frequently sustained under the present system.

* * *

Searchlights. In modern naval warfare the electric searchlight necessarily plays a very important part.

Every man-of-war is provided with two or more of these powerful reflectors as a safeguard against the attack of torpedo boats or for signaling purposes. At harbor fortifications the searchlight is invaluable for detecting the approach or attack of an enemy by night. A search lamp, or that part of the apparatus which generates the light, is nothing more, as is well known, than a focusing lamp mounted in a cylindrical box so arranged as to send the beams of light in any desired direction by the aid of a reflector. Of the whole apparatus the latter is by far the most important. It is absolutely necessary to employ a reflector in order to obtain a parallel beam, and this reflector has up to the present time almost invariably been made out of glass. As it takes a number of weeks to accurately grind one of these glasses, a substitute has been widely sought for in the way of a metal reflector. Attempts have been made to obtain metal reflectors by spinning them in moulds, but it has been found impossible to spin them true. Cast metal reflectors have also been tried, but the cost of grinding and polishing them has been found excessive. Stamping has also been tried with equally poor results. Mr. Sherard Cowper-Coles, of England, suggested a rather ingenious method of making a reflector at a moderate cost electrolytically. In a word, his method consists in preparing a glass mould to form a true parabolic reflecting surface. It is only necessary to accurately shape and polish the convex side. Over the prepared surface a coating of metallic silver is chemically deposited. The mould is then immersed in an electrolyte of copper sulphate, and while slowly revolved, copper is deposited. The metal portion is then separated from the mould and coated with a film of palladium to prevent tarnishing. This process is said to give an excellent reflector at a moderate cost.

As previously stated, the main object of the reflector is to make the beam of light parallel. In practice, however, it is impossible to obtain a reflector which will not absorb some light or which will make a beam perfectly parallel. The light, therefore, gradually becomes scattered as the distance from the source increases, but in spite of this drawback powerful lights can be thrown under favorable conditions a distance of 100 miles.

In the larger forms of projectors the adjustment of the beam is accomplished by means of screws or gearing. Searchlights on ships are usually equipped in this manner. To enable the regular pressure, generally in use on ships, of 110 volts to be utilized for operating the searchlight, a rheostat is frequently placed in circuit with the arc lamp. Thus resistance can be either added or cut out at will.

The harbor fortifications in the vicinity of New York are well equipped with searchlights. Sandy Hook is provided with one, Fort Wadsworth has two and is said to be fully equipped for operating them, and Willets Point also has an efficient plant of this nature. The searchlight at Sandy Hook is probably the largest in the world. It is the projector that was on exhibition at the Chicago Columbian Exhibition in 1893 and which attracted so much attention. It weighs 6,000 pounds and has a reflector five feet in diameter. In operating it requires a current of 200 amperes at 50 volts, or in other words, takes an activity of 13.4 horse-power. The upper carbon is $1\frac{1}{2}$ inches in diameter, the lower carbon $\frac{1}{4}$ inch less. This light is provided with a Mangin reflector, which is a spherical mirror whose inner and outer surfaces are of different radii. In this apparatus the

light is not allowed to pass directly from the arc into the beam, but is thrown from the arc back to the reflector by means of a small mirror before being projected outward.

The best searchlight mirrors are said to be manufactured abroad, there being but comparatively few made in this country. There would therefore seem to be a wide field open in this line provided some economical process could be discovered for turning out this article.

* * *

Wave and Tide Motors.

Some little time ago Mr. Thomas Edison, Jr., suggested a means of utilizing the power of the ocean for generating electricity. It may be of interest to our readers to know that several systems of the above nature have been in use for a number of years which are said to have proven comparatively successful. One of these plants is situated on the Pacific coast, the electricity generated being transmitted to Los Angeles, where it is used for various commercial purposes. A wharf 26 feet in width has been built out in the ocean a distance of 350 feet, at which point three motor floats are located. The motion of the waves in raising and lowering these floats is made to pump water from a small reservoir into the pump cylinders and forces it into a storage pressure tank, where it is subjected to a heavy air pressure. This water then flows out of the tank through a nozzle, and impinges upon the buckets of a water wheel which in operating drives a dynamo. The accumulated pressure in the pressure tank is made to exert a force upon the pump pistons so as to resist the tendency of the floats to draw the pistons down. This feature of the plant, invented by Mr. Parvin Wright, is an exceedingly important one, as it enables the floats during storm periods to ride upon the crests of the waves without dropping into the trough of the sea, in which case they would become inoperative.

Recently a number of very thorough tests of this system are said to have been made, extending over a period of sixteen days, during which time the weather conditions varied from calm to stormy, the number of waves per minute varying from three to eight. The tests showed that each float developed from 2.3 to 3.5 horse power, the rating being taken from the power developed at the water wheel. It was further stated that the variations in the power were due to the varying conditions under which the motor was tried. The cost of erecting a plant capable of generating 1,000 horse power, with a transmission line to Los Angeles, is placed at \$175 per horse power.

As will readily be seen, this is considerably more than it would cost to erect a plant of the same capacity to be operated by steam. On the other hand, the operating expenses should be much less in the case of the wave-motor system, especially where coal is more or less difficult to procure.

Another interesting attempt to utilize the power of the ocean has recently been made at Ploumanach, on the northern coast of France. In this region, owing to the nature of the coast, which abounds with numerous deep indentures, there is a difference in tide level frequently amounting to as much as twenty-nine feet. It is these exceedingly high tides that are made use of in the plant in question. A natural pond, triangular in shape, with its base towards the shore, is separated from the sea by an embankment. This pond has an area of almost four acres. In the embankment automatically operated gates have been constructed, which, owing to the angle at which they are placed, open when the level of the sea exceeds the height of the water in the pond, while on the other hand they are closed by the weight of the water in the pond when the tide recedes. This head of water is then utilized to turn two water wheels, which operate dynamos, the electricity generated being utilized for lighting purposes. The capacity of the plant is said to be about 2,000 horse-power hours daily. In order to provide

a sufficient supply of current for lighting purposes during the hours of low tide, a storage battery has been installed which is charged during the hours of full running.

It would seem as though tide mills of the above nature could be advantageously employed at various points along the Pacific coast, where the tides rise and fall from eighteen to twenty feet, or on the Bay of Fundy, where tides have still greater alternations.

Under the Searchlight.

Notes and Comments on Various Topics.

War on the General Electric.

A leading official of the General Electric Company says: "It is true that we have received some contracts from the Government for special work, but the amount of money involved does not begin to compensate us for the loss of contracts which we undoubtedly would have received if there were no disturbance to general business from the Cuba trouble. Where we get one contract from the Government I may say we lose ten from syndicates which were contemplating new work of various kinds."—*Boston News Bureau.*

If the rumor of war is affecting the business of the General Electric Company, as the above statement leads one to believe, the holders of the preferred and common stock will be obliged to gird up their loins for another long and patient wait if war actually breaks out. Such an event would make an excellent excuse for postponing the rumored settlement indefinitely.

* * *

THE *Electrical Review*, London, in a recent issue refers to some exceedingly curious experiments which show that the electric arc is capable of acting either as a telephone transmitter or receiver. The arrangement of apparatus is described as follows: "The primary of a small step-up transformer was connected up in the circuit of the electric arc; a microphone and battery were put in circuit with the secondary of the transformer. When the end of a sounding tuning-fork was placed in contact with the microphone, the same note was heard distinctly at the electric arc. In order to show that the electric arc is capable of acting as a telephonic transmitter, the microphone in the above-described arrangement is replaced by a telephone, and the sound waves are concentrated on the arc by a funnel. Speech, singing, whistling, thus directed on the arc, are heard distinctly at the telephone. The explanation of this phenomenon is plain, when it is remembered that the resistance of the arc varies with the density of gases through which the current passes; the variations of the resistance will produce corresponding variations of the current which, by lateral induction in the transformer, are transmitted in an intensified form to the telephone." Our contemporary across the water aptly concludes the description in the following humorous vein:

"We do not recommend this invention for commercial use; the language transmitted through the present telephone is usually heated enough; at least, there is no necessity for passing it through an electric furnace."

* * *

WE have announced lately the success of the Westinghouse Company in securing contracts for electrically lighting the catacombs of Rome and the Pyramids of Egypt, and it affords us no little pleasure to be able to inform the company that there is a chance nearer home for them to do a stroke of subterranean business that has none of the revolting features of the European charnel vaults. Col. Joe Bennett of Sullivan, Mo., we are told in the *St. Louis Republic*, says that the magnificent cave near his native town is to be lighted by electricity. "The Colonel," says the *Republic*, "is enthusiastic in his praise of the cave and claims that its natural marvels present more awe-inspiring scenery than the famous Mammoth Cave. The cave extends for seven miles. Its generous amount of stalactites and sta-

lagmites are formed in the shape of trees and animals. In the glare of torches they assume weird and fantastic shapes. One might imagine it a primeval forest inhabited by wonderful monsters lurking in the shadows ready to seize upon people who intruded upon their sacred precincts." What a chance is here offered to develop the art of subterranean electric illumination!

* * *

THE Boston News Bureau says:

The General Electric Company has since Jan. 1 cancelled and burned \$2,000,000 more of its debenture bonds, leaving the amount outstanding slightly under \$6,000,000.

Possibly the General Electric Company has set an example burning bonds in the hope that the holders of the common and preferred stock will burn their securities. This would probably have been done long ago if the discouraged stockholders had not been buoyed up by constant rumors of a speedy settlement which never materializes.

* * *

THE following little anecdote recently appeared in the Cincinnati Post:

One of the most prominent electricians in the city resides in the country in a very handsome home. He is early at his fireside from the day's toils and is ever warmly welcomed by his loving wife. The brute in man must assert itself, however, once in a while. The affectionate greetings he nightly received made him too over-confident of himself. He imagined that he was the entire show. One evening last week he returned very much dejected in appearance. His close observing wife noted the cast-down tendency and said: "Too much work, John."

"Oh, no, I've sad news," replied the careworn husband, scarcely noticing the anxiety of his better half.

"What can it be?" queries she in hesitating tones.

"Well, the Government needs electricians to attend to the disappearing guns, and as war is sure, why, they have decided to call upon the cities. Each city must contribute 25."

Then he chuckled inwardly as he thought of the train of thoughts the suggestion would start.

"Well, does that include you in Cincinnati?" rather sorrowfully, but not quite as much of an exhibition as he had expected.

"Yes! Yes! that takes me."

Instead of weeping and wailing as he had figured on, she smilingly remarked: "Well, when you go, auntie and I will take a trip to California; we've been anxious to go for a long time."

Now when he leaves home he takes only that part of the paper that contains no war news.

* * *

REGARDING the matter of lost stock referred to in our last issue, the Kansas City Times says: "The General Electric Company, one of New York's big combines, is advertising for a number of shares of its stock that have gone astray in a freight car somewhere between Schenectady, N. Y., and Worcester, Mass., where the company is putting in a street railway plant. Car and all is missing. No doubt the hue and cry is mostly on account of the car. A single car-load of stock in a modern New York trust wouldn't be worth bothering a great deal about. The directors could issue another million or so shares at any time. But a freight car is another matter." How well the methods of the General Electric Company are getting to be known!

* * *

A MAN employed as a motorman on a St. Louis street railroad, and heretofore bearing the name of Patrik, by gift of his parents, has had it changed to Percy by the court, on the plea that "through his connections with the company, and among those with whom he associated in a social way, the name of Patrik has been used unpleasantly, thereby placing the petitioner in an embarrassing position." What's the matter with St. Louis?

Canadian Electrical Association.

Arrangements have been completed for the next convention of the Canadian Electrical Association, which will be held at Montreal on June 28, 29 and 30. Besides the business sessions, at which a number of valuable and practical papers will be read, many special features have been decided upon.

ELECTRICAL EXHIBITION NOTES.

Magnetic Ore Mining Exhibit.

A great deal of public interest attaches to the work which Mr. Edison has been doing for some few years past in magnetic ore separation, and the general curiosity on the subject will be satisfied at the approaching Exhibition, where Mr. Edison will actually exhibit a model built for him by Mr. Sigmund Bergmann which illustrates admirably the fundamental principle of the process. This model will be kept running by a small motor, and the iron will be continuously separated from the crushed rock in full view. Mr. W. S. Mallory, the manager of Mr. Edison's mining works, is sending to the Exhibition samples of crushed rock in its various stages, as well as samples of the separated ore and of the briquettes which are sent to the furnace. He is supplementing this by some four or five ton masses of rock, which Mr. Edison takes bodily out of the hillside by means of huge excavators, and the magnetic condition of these ponderous masses will be shown and tested by magnets. Around the exhibit will be placed photographs illustrative of the scenes at the mines themselves, and the whole will constitute one of the most instructive demonstrations possible. This valuable exhibit will be placed along one side of the Concert Hall of the Garden in company with a number of very interesting special features which have already been arranged for.

WIDESPREAD INTEREST IN ELECTRICAL EXHIBITIONS.

The interest taken in Electrical Exhibitions is by no means limited to Greater York, and extends in every direction. Numerous comments have been made by the foreign press and by journals in different parts of the country, and Prof. R. B. Owens, Director-General of the electrical work at the Omaha Exposition, beginning in June, has been specially instructed to visit this city in May and acquaint himself with the exhibits and the work being done. Many inquiries have come from foreign managers and manufacturers as to the time and nature of the Exhibition, and it is a fact beyond question that a direct stimulus will be given to export trade. As was the case at the Exhibition in 1896, many of the exhibits will go straight from the floor to foreign countries.

LARGE ACCESSIONS TO THE MEMBERSHIP OF THE NEW YORK ELECTRICAL SOCIETY.

One of the most striking evidences of the general interest that the Exhibition is awakening is to be found in the remarkably large accessions to its membership which the New York Electrical Society has enjoyed since the Exhibition was announced under its auspices. The desire of the Society to promote the welfare of electrical applications is recognized as highly laudable, and has elicited not only many words of commendation, but has brought the largest number of applications for membership within a given time that the Society has known in its history. In almost every instance the new members inquire as to the Exhibition, and express the wish to aid it in any way possible. Last month the Secretary announced a list of a round score of new members, and the following were elected members of the Society on March 30:

New York City—W. C. Broadhurst, H. M. Lamont, Edwin H. Daly, Gustavo Lobo, Richard Lamb, J. B. Taltavall, Fred Catlin, Clarence W. Phillips, Marcus Nathan, Harris I. Goldstein, A. L. Saruya, Joseph Miller, Henry C. Mortimer, Jr., Earle Ovington, Dr. C. A. Doremus, Geo. F. Porter, A. L. Doremus, Morton Webster Haddock, Richard Koch, H. A. Strauss, F. M. Hawkins, Elmer P. Morris, Jens Skougaard, S. Clover Way, Christopher M. Lowther, W. J. Clarke, R. E. Gallagher, E. N. Stevenson, Theodore B. Entz, W. H. Palmer, Wm. F. Crawford, C. W. MacMullen, C. H. Clark, Jos. C. Youenes, L. B. Pearson, Fenton S. Grant, Phillip Menges, D. L. Collins, Louis S. Levy, Samuel F. Butterworth, Geo.

Sanders Weston.—Brooklyn, N. Y.—John Maguire, John Joyce, Calvin Winsor Rice.—Mt. Vernon, N. Y.—Conrad Watober.—Newark, N. J.—C. D. Warner, C. N. Wheeler, J. J. Bellman.—Bloomfield, N. J.—C. Morris Haskell.—Westfield, N. J.—E. Y. Porter.—Weehawken, N. J.—Harold Briesen.

COMMUNICATION.

The Firman Patent.

Electricity Newspaper Co., New York.

GENTLEMEN: The attorneys for the Western Electric Company (Bell manufacturers) having published a statement over their signature, which, by inference, indicates that the Firman patent covers all forms of multiple switchboards, and that this patent was upheld in their favor in a recent California suit, we desire to publicly announce that the Firman patent does not, in any manner whatsoever, affect the multiple transfer system of the switchboard of this company.

We challenge a single particular in which the Firman patent claims refer to our devices. Respectfully,

WESTERN TELEPHONE CONSTRUCTION CO.
Chicago, April 1, 1898.

Electricity in Coal Pits.

The Colliery Guardian publishes some interesting extracts from a report drawn up by Mr. Leproux, of France, on the use of electricity in the Belgian and Westphalian coal mines. In the course of a recent tour through Belgium and Westphalia, Mr. Leproux had the opportunity of studying the state of this question in the districts containing fiery mines of these two countries; and the following is the result at which he arrives from the safety standpoint, quite independently of any economical consideration:

"Neither in Belgium nor in Westphalia do there exist any power-transmission installations any portion whatever of which is in contact with an air current decidedly impregnated with firedamp. In fact, the only dangers that have had to be guarded against are those of fire and also shock through personal contact; and the restrictions laid down in this respect do not differ from those that have been found necessary for surface installations connected with industrial establishments. As to the danger of exploding gaseous or dusty mixtures, if any attention has been bestowed upon it, this may be said to be only for appearance sake, at any rate, up to the present time.

"The measures taken are—in Belgium a careful encasing by special conductors of the parts capable of giving out sparks, and in Westphalia the adoption of polyphase current motors without brushes, and the use, also, of strongly-armored cables. In both countries the Government has been led to require for such installations that previous permission be applied for and obtained, but subject, at any rate ostensibly, to the appointed regulations, which are more stringent in Belgium than in Germany." "I consider," concludes Mr. Leproux, "that this difference is largely due to the dangers of firedamp being far better known, more studied, and especially more dreaded in the former than in the latter country, and that therefore the efforts already made in other countries, especially England, are more closely watched."—*Electrical Engineer, London.*

Electric Progress in Corea.

The United States Consul-General at Seoul, Corea, has sent the State Department at Washington the following letter regarding the electric railways of Seoul:

"I have the honor to inform you that a company has been formed in the city of Seoul for lighting the streets and residences with electricity and for operating electric street railroads through the principal thoroughfares. Only the latter will be begun at once.

"The company, known as the Seoul Electric Company, is composed entirely of Koreans, with the governor of the city as president. They have an exclusive franchise from the Department of Public

Works, Agriculture and Commerce, and have paid in about one-half of the capital of \$300,000.

"This company has made a contract with Mr. H. Colbran, of Denver, the American contractor for the construction of the Seoul-Chemulpo Railroad, for the construction and equipment of an electric trolley street railroad of the latest and most improved design. The railroad will be about six miles in length, and will run from the station of the Seoul-Chemulpo Railroad through the south gate of the city, along the broad streets, past the new palace and foreign quarter, through the busiest part of the city and the great east gate, to the tomb of the Empress.

"Mr. Colbran has received a cash payment of \$100,000 with his contract, and the work will be rapidly prosecuted.

"It is regarded as a profitable enterprise, since, with a city of 300,000 people and no amusements, there will probably be enough passenger traffic from curiosity seekers to make it pay for a year or so, while the people are being educated to the point of regarding the road as a necessity.

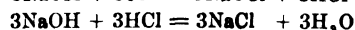
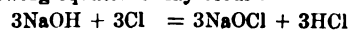
"At present, all the financial ventures of importance in Corea are in the hands of Americans."

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XVII.—The Hermite Bleaching and Disinfecting Processes.

The electrolysis of solutions of chlorides always produces chlorine at the anode, and the hydrate of the base (sodium, potassium or magnesium) at the cathode. In the electrolytic alkali processes, the aim of the inventor has been to effect removal of these products before they can react one with the other. In the electrolytic bleaching processes, the chlorine and the caustic hydrate are allowed to react, in order that the chemical changes represented by the following equations may occur:



If the temperature be allowed to rise above a certain point, a further action will occur, and chlorate will be produced. (See Chapter V of this series). It is therefore necessary in all electrolytic bleaching and disinfecting processes to pay great attention to the temperature, as chlorates are useless for bleaching purposes. The hypochlorites on the other hand are very active, and the Hermite process is simply one for producing these hypochlorites in a convenient and economical manner by means of the electric current. In principle these processes resemble the Kellner bleaching process, described at length by the writer in Chapter VI of this series, but the apparatus and details differ, and hence it has been possible to obtain separate and distinct patents for these two processes.

The Hermite bleaching process has been in use for many years at Stjernfors in Sweden; and it is also stated to be in use for bleaching purposes at La Haye in Normandy, and at Boston, Mass. The Hermite disinfecting process has been experimented with at Havre, Marseilles, Worthing, Lytham, Ipswich, Southampton and Bombay; and the plants at the three latter places are believed to be still in operation.* In order to enable the readers of *ELECTRICITY* to understand the processes, the plants and procedure at Stjernfors and at Ipswich will be described in detail.

The Hermite Bleaching Plant at Stjernfors, Sweden.

—The apparatus used here for preparing the bleaching fluid consists of a series of vessels through which the electrolyte is constantly circulated by means of

a pump. Each vessel contains a horizontal spindle, bearing a large number of disks made of zinc plates capable of rapid rotation by means of a pulley wheel. These zinc disks are the cathodes of the cell, while an equal number of pieces of platinum gauze fixed in lead or glass frames hang between each of the consecutive pairs of zinc disks and act as anodes. The rotation of the spindle bearing the disks and the rapid circulation of the electrolyte cause a complete mixture of the solution, and little chlorine escapes as gas from the cell, the greater portion combining with the hydrate to form hypochlorite, in accordance with the chemical equation given above.

In Hermite's original patents, a mixture of magnesium and sodium chloride solution was recommended as the electrolyte for use in this cell. The electrolytic decompositions led to the production of insoluble magnesium hydrate at the cathodes, and the zinc disks speedily became coated with a deposit of this compound. Fixed scrapers did not satisfactorily remove it from their surfaces, and the EMF. necessary to work the process became permanently increased owing to the resistance offered by this film of hydrate on the zinc plates. The writer believes that on this account the procedure has been altered, and that sodium chloride is used alone in preparing the electrolyte for the cells. The dilute solution of hypochlorite, which is obtained by passing the sodium chloride solution rapidly through the 5 cells which form the system, is run into the pulping vat, where it is intimately mixed with the sulphite wood-pulp by means of mechanical mixing arms. An output of 1,750 kgs. bleached wood-pulp per day is obtained by an expenditure of energy equal to 75 HP., and of salt 192 kgs. The Hermite bleaching process has been operated at Stjernfors since 1890, and the firm who own the works state that the bleaching of the pulp costs them less now than by the older process with bleaching powder. In the chapter already alluded to, dealing with the Kellner bleaching process as carried out at Hallein, the writer gave a detailed examination of the costs of bleaching by means of sodium hypochlorite solutions, and readers interested in this aspect of the subject may refer to the issue of *ELECTRICITY* for October 6, 1897, for further information upon it. It may be pointed out, however, that while at Hallein 200 HP. is said to bleach 15,000 kgs. wood-pulp per day, at Stjernfors 75 HP. only suffices to bleach 1,750 kgs., and therefore the Hermite electrolyzers apparently possess only one-third the efficiency of the Kellner electrolytic cells. Wood-pulp however differs greatly in coloring matter, and therefore the difference in efficiencies of the two electrolyzers may be more apparent than real. At La Haye the Hermite process is used for bleaching cotton goods.

The Hermite Disinfecting Plant at Ipswich, England.

—The apparatus used for preparing the disinfecting fluid at this place does not differ greatly from that in use at Stjernfors. Sea water is used as the electrolyte. One of the forms of electrolyzer used possesses a pair of horizontal spindles, each carrying a large number of the zinc disks. The platinum gauze is carried by a frame work of glass rods. This form of electrolyzer can produce 250 grms. chlorine, as hypochlorite, per hour. The electrodes are in parallel, and an EMF. of about 6 volts is requisite to work the cell to the best advantage.

A modified form of the electrolyzer has been designed for the use of currents having a higher EMF. than 6 volts. In this a number of the zinc and platinum pans of electrodes are coupled in series. A full description of the apparatus will be found in British patent No. 6,497, 1894.

The energy required to produce 1 kg. chlorine in the form of hypochlorite with this apparatus is given as .48 HP. day, or 11.4 HP. hours. At 100 d. per EHP. hour this represents a cost of 1.14d. = 2.28 cents per 1,000 grms. active chlorine. The solution obtained by the electrolysis of sea water contains both sodium and magnesium hypochlorites. The latter quickly decomposes into magnesium hydrate

and hypochlorous acid when mixed with the sewage effluent or when allowed to stand.

This solution, according to M. Hermite, is a powerful deodorizer and an efficient sterilizing agent. The reports of the numerous experiments that have been carried out respecting its action on sewage are however very conflicting. With a clear effluent there would appear to be no doubt of its deodorizing and sterilizing properties, when used in sufficient quantity, but upon solid faecal matter its effect is much less satisfactory. The most important independent criticism of the process as applied to sewage has been made by Sir H. Roscoe and Mr. Lunt.*

They found that the weaker solutions of hypochlorite were exceedingly unstable, while the stronger solutions containing 1.0 gram active chlorine per liter, though much more stable, occasioned a considerable loss of energy in the electrolyzer in order to obtain them. They nevertheless stated that the solution containing .25 gram active chlorine per liter was an excellent deodorizer.

The experiments made with the process at Ipswich in 1895 led Mr. Napier, the Borough Analyst, and Dr. Elliston, the Medical Officer, to report favorably upon the process as applied to the sewage of their town, the desire here being merely to arrest decomposition of the organic matters until the sewage had been carried out to sea. The Ipswich plant, which cost \$12,000, was started in May, 1895. A 30 HP. engine drives dynamos yielding 600 amperes at 28 volts; 4 electrolyzers, coupled in series, yield 2,400 grms. chlorine per hour. The electrolyzers are equal to providing 1 gram chlorine per head of the population per 24 hours, and the cost of running the installation is stated to be \$1,680 per annum, or 3 cents per head per annum.

Last year a complete plant was shipped to Bombay, in order that a portion of the sewage of that city might be treated with the Hermite deodorizing fluid. The experiments that have so far been made there have not been very successful,† and unless the second series, which were to be commenced in the autumn of 1897, gave more satisfactory results, it was not intended to permanently adopt the process for the treatment of the sewage of that city.

The Hermite deodorizing fluid has been experimentally used in Paris hospitals for antiseptic purposes by Dr. Proger with good results.

Conclusions.—As a convenient and simple means for producing bleaching or disinfecting fluids from sea water, the Hermite electrolyzers are to be commended. The long period for which the Hermite process has been in use at Stjernfors would seem to show that under certain conditions it is more economical than the older bleaching methods, and the opinion expressed in Chapter VI with regard to electrolytic methods of bleaching is thus confirmed. The remarks made in that chapter concerning the cause of the slow rate of growth of the electrolytic bleaching industry apply equally here.

As regards the use of the Hermite fluid for deodorizing sewage and for disinfecting purposes generally,‡ the future is less certain. In many cases, where the sewage is turned directly into rivers or into the sea, there is at present no obligation to deodorize it, and the adoption of the Hermite treatment would simply be resisted as an unnecessary expenditure. In cases where treatment of the sewage is absolutely essential, the Hermite process fails in that it is only successful when applied to the clear effluent, and the nuisance arising from the decomposition of the solid faecal matters is in no way abated. As an alternative procedure to the use of chloride of lime and carbolic acid, for the mere purpose of lessening the effluvia from main sewers, it may find adoption; but it certainly cannot be regarded as the solution of what is still one of the greatest problems of the age—the production of innocuous and useful materials from the sewage of our great cities.

**Jour. Soc. Chem. Industry*, 1895, p. 224.

†See Report, *ELECTRICITY*, October 13, 1897.

‡These remarks apply equally to the Wolff sewage treatment process in the United States.

*The writer has applied to Messrs. Paterson & Cooper, the agents for the Hermite processes in England, for information as to the present position of the processes at the places named, but he has not received any answer to his inquiry.

INSULATION AND CONDUCTION.*

BY REGINALD A. FESSENDEN.

(Continued from page 183.)

In the formula, the valency was introduced. This term has no definite meaning, as the valency varies with the compound. Consider the writer's chart of the elements (Fig. 3) a modification of those of Meyer, Newlands and others. On one side are seen the metals of the arts. Above them in vertical rows are marked the figures 1, 2, 3, 4, etc. These figures indicate the number of chemical linkages which as a general rule the elements under the figures tend to take up. But there is no very definite rule. Among the univalent metals some unite with bivalent atoms, as does copper, and in general all that can be said is that a certain valency holds generally and not in general. Consequently when we find that by taking a group of metals having very closely the same values of Young's modulus, as for instance gold, silver and aluminum, their conductivities are, within the limits of errors of observation, proportional to the velocity of sound \div valency, and that in any of the group of metals having the same valency the conductivity is directly proportional to the velocity of sound, within experimental errors, we are to a certain extent justified in making a choice of valencies when this is needed. Fortunately, however, this only occurs in two cases: 1st, we must suppose copper to have twice the valency of silver, which we might, *a priori*, have granted, for though they are in the same group yet copper has markedly through all its salts twice the valency that silver has; 2d, that thallium has twice the valency of aluminum, a supposition which has no other justification than the fact that since the formula holds in other cases where the valency is known we have a certain right to use the formula to find the valency.

Now it is well known, especially from facts in organic chemistry, that similar atoms or molecules can combine together to form what are called polymerized substances. For instance three molecules of C_2H_2 , acetylene can form one molecule of benzol, C_6H_6 . In general we find that these polymerized compounds are more crystalline and have higher melting points than the original substance. Also we note that the number of atoms in such a polymer is generally a multiple of the valency of the atom. Carbon, for instance, seems to prefer to go in groups of four.

Considering now the table of elements, we see that as we pass along from row to row, and as the valency increases, the substances get more crystalline and in many ways evince a linking together.

- 1st. As mentioned, they are crystalline.
- 2d. Their specific heats get abnormally low, this indicating that they are polymerized, or plexed.
- 3d. They are capable of existing in allotropic forms.
- 4th. Their vapor densities show that several atoms are joined together into one molecule, and hence they are almost certainly polymerized as solids since the general tendency of heat is to disassociate. Consequently there is some evidence for the theory that metalloids differ only from metals in that they have a greater tendency to polymerize from their higher valencies, which are probably in some way dependent upon the shapes of the atoms, and are so more crystalline, etc. We might therefore look for some evidence of polymerization among the metals. This is readily found, as before, from variation of the specific heat from its theoretical value. If this linkage were but loose, it is evident that it might affect the specific heat but little and yet have a marked effect on other phenomena. For instance, we might suppose that it would affect long sound waves less than short ones.†

*Paper read before the 123d meeting of the American Institute of Electrical Engineers, New York, March 23, 1896.

†The writer ventures to suggest that the velocity of very short waves of sound in copper may be found somewhat less than half of that given now for audible tones, while that of lead may be reduced to but one-eighth of its value as given at present.

We might therefore consider that when the period of a sound wave coincides with that of the molecules it is a heat wave; the period of the amplitude of a sound wave being the period of the heat wave. If this be proven by experiment we would have this relation: the electric conductivities are in the same ratio as the velocities of very short sound waves, being thus analogous to Maxwell's law for the velocity of light in insulators, in that the velocity varies with the periodicity.

We have seen above that the electric resistivity varies directly as the valency. Also it has been indicated that there is some evidence to show that the polymerization or plex varies as the valency. There-

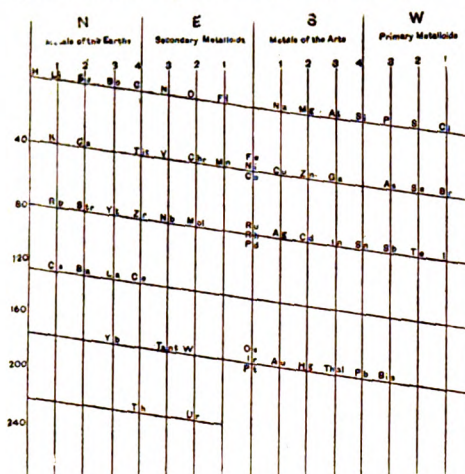


FIG. 3.

fore we are led to assume that increase of resistance accompanies polymerization or the linking together of the atoms into groups. We see that this might hinder the transmission in various ways since the groups would not vibrate so quickly as the single atoms and there would be fewer of them per unit cross-section. Anything, therefore, which tends to give molecular complexity tends to give high resistance; hence we see why alloys are generally higher in resistance than the average of their components.

The resistance increases with density and molecular complexity and inversely with the elasticity. Consequently whether a resistance increases or decreases with temperature will depend upon whether the molecular union is weakened at a less or greater rate than the elasticity falls off.

In getting a concept of this we may consider a conductor as analogous to a government department, the different atoms or officials being bound together into groups by valency bonds, the analogue to which is evidently "red tape." The rate at which a given impulse is handed on will evidently depend inversely

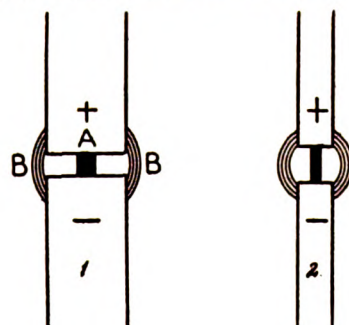


FIG. 4.

upon the amount of red tape and the density, or stupidity, of the individual official. The two causes are often confused.

We must therefore, for solid insulation, get substances which are strongly linked together, of great density, and of small modulus of elasticity. The first is the property which varies most, since density and elasticity vary between comparatively narrow limits.

3. *Conductivity in Fluids.*—The nature of the manner in which electricity is conducted in electrolytes has

been very thoroughly worked out by Clausius, Arrhenius, Hittorff, Kohlrausch, Nernst, Ostwald and others, and the work of these physicists has led to the linking together of results in a way which is simply marvelous. As the results can be obtained from works on physical chemistry, a brief resume is given.

The atoms of a solid are held together by the force of cohesion and driven apart by the hitting of the atoms on each other, due to the fact that they are in vibration, possessing kinetic energy proportional to the temperature. The molecule may also be pulled apart by the cohesive attractions of its atoms for other atoms. Whether a substance is a solid or a gas depends upon whether the fraction

Cohesive force of atoms for one another \div external force Kinetic repulsion \div cohesive attraction for other atoms is greater or less than unity. We can thus turn a substance into a gas in two ways, i.e., by increasing the kinetic energy of the atom by heating it, or by bringing it in contact with other atoms, when, if the sum of the terms in the denominator is greater than the numerator it will dissolve.

We have to distinguish two kinds of linkages in solids, the cohesive force of the atoms for one another in uniting to form a molecule, and the attraction of the molecules for each other. The former generally is stronger than the latter; consequently we may have a substance which on being put into contact with a solvent will have its molecules pulled apart from one another but not its atoms. In the presence of another solvent, however, the second term may be sufficiently great to pull apart not only the molecules but also the atoms of the molecules. The substance is then said to be not only dissolved but disassociated. But dissolved substances give an osmotic suction per sq. cm. which is equal numerically to the kinetic pressure which the substance would have if it were turned into a gas at the same temperature and volume as the solution. A number of proofs of more or less validity have been given for this, but it seems to the writer to follow at once from the obvious fact, that if we take a solid and heat it and dissolve it the kinetic repulsion must always equal the cohesive attraction plus the vapor pressure when equilibrium is reached.

This phenomenon of osmosis has been generally treated of as due to pressure and the dissolved substance to exercise a pressure equal to that which it would have if turned into a gas at the same temperature and volume. The writer (in the *Elec. Review*, London, Nov. 27, 1891.) pointed out, as above, that the results were better explained by supposing that the solvent took up the cohesion of the solute, and that this got rid of the great difficulty of the disassociation theory, i.e., that solution was generally accompanied by heating. Recently this theory has been put forward by other well known physicists. Prof. Poynting (*Phil. Mag.*, Oct., 1896,) has treated the subject mathematically, and whilst the mathematical reasoning cannot be considered conclusive, as Prof. Poynting himself states, yet, as he puts it, it shows "that it is not necessary to ascribe osmotic pressure to disassociation, but rather to association, or some kind of combination of salt and solvent." I have ventured therefore, in view of this fact, to do what I would not have done otherwise, i.e., to substitute my own conception of a suction for that of a pressure, otherwise making no change.

In this way by measuring the osmotic suction we can tell whether a salt is disassociated or not; and it is found that only those salts which are disassociated can conduct electricity. The molecules split up generally into two parts, one charged with positive, the other with negative electricity. These charged parts or ions, when placed in an electrostatic field, move with a velocity proportional to the slope of potential and to the specific ability of each ion to move among the crowd of molecules of the solvent. Consequently the faster an ion can get along through the crowd of other molecules, i.e., the faster it can diffuse, the faster will the electricity be carried, and the greater the amount carried per second for a given

slope of potential; also the greater the quantity of electricity carried per ion the greater the current. The total quantity carried will be the sum of that carried by each ion, so that by adding the velocities of the ions we get the total velocity with which the electricity is moving.

The conductivity of a solution is thus dependent upon the following:

1. How powerful the attraction of the molecules of the solvent is for the ions of the solute, for on this depends how much of the solute is disassociated, i. e., how many ions are set free to carry the current.

2. How fast the ions move.

3. What the valency of the ions is.

In designing insulations, the first is the important point. For from it we see that two good insulators mixed do not necessarily make a good insulator. A solid may dissolve in one substance and be an insulator in solution, but in another solvent may conduct quite well.

This is what makes the chief difference between fluid insulators, for practically all the fluids which are not simple elements, like mercury, have very high ohmic resistance, and all have practically about the same dielectric strength. The ohmic resistance of pure water is, according to Kohlrausch and Heydeweller, about one megohm per cubic centimeter, consequently on account of its non-inflammability and great specific heat, its great heat of vaporization and low boiling point, it would be a very valuable insulator for some types of apparatus were it not for the fact that it dissolves almost everything in slight proportions and splits them up into ions. Var-nished paper will dissolve in some high resistance oils, forming a conducting solution.

4. *Conductivity in Gases.*—There is much evidence to show that conduction in gases is electrolytic, more especially J. J. Thomson's beautiful work on this subject. Also the fact that in air or CO₂ carbon is deposited on the negative pole, sometimes to the thickness of more than an inch in enclosed arc lamps, according to Marks, while in hydrogen or hydrocarbons in many instances the carbon is deposited on the positive carbon, would seem to favor this view. Also in its favor is Prof. Elihu Thomson's observation of the formation of copper "trees" in incandescent lamps with coppered filament joints. Against this is Schuster's observation that the metallic lines in the spectrum have a fairly high velocity, and also the general appearances of the arc, which looks as if something were going in one direction down its center and something else back on the outside. Also there is one other phenomenon which looks as if it were convective. This is the fact that if we take a solid carbon and bring it nearer to a similar carbon while the current is passing, the resistance first decreases and then increases. This was, I believe, first pointed out by Mrs. Ayrton in her admirable paper on the subject. The reason of it has not, I believe, been given; it seems to be due to a necessity for circulation in the arc. If we have two carbons as in Fig. 4, at 1, the center part of the current seems to flow all right, but the part B cannot flow unless the + carbon is very hot, and this is only cured by increasing the current so as to heat the whole carbon up or by reducing the cross-section, as at 2 in Fig. 4. Whether a carbon is cored or not has nothing to do with this increase of resistance on the distance being shortened, as all that coring does is to diminish the cross-section of the carbon, and I have repeatedly found by actual test that the difficulty is entirely obviated by using carbons of + or — cross-section, provided the greatest thickness at any point of the cross-section is less than that of the cored. The phenomenon is evidently analogous to the jumping back of the discharge in a Geissler tube when the electrodes are brought too close together. The theory of this was given by J. J. Thomson, and it was by applying this that I got over the difficulty with the carbons. A true arc can be run from a much lower voltage in open air than is generally

supposed when the section of the carbon at any point is not more than $\frac{1}{16}$ cm. thick. On the whole, the evidence seems to be in favor of the belief that both convective and electrolytic discharges take place in air. The whole subject is very fully treated in J. J. Thomson's "Recent Researches in Electricity and Magnetism." There can be, in my opinion, very little doubt but that when a true electrolytic discharge takes place, as it does in a hot flame, the conductivity is proportional to the velocity of sound in the gas, though so far I am not aware that any experiments have been made on the subject. It is possible that in certain cases the elasticity itself may be a function of the slope in the electrostatic field. As the vacuum increases up to a certain point, the dielectric strength decreases, and this point depends somewhat on the electrodes and voltages, and has led to the amusing result that on the average every two years the discovery is announced that a vacuum is a good conductor. Above this the discharge appears to get more and more convective, and a fact may be stated which I have not seen mentioned, i. e., that the largest quantity of X rays is not got from a tube unless the path of the positive particles back to the cathode is blocked up as much as possible. An experimental tube made by Mr. Meadowcroft for the writer last spring, in which there is a small tube running from the back of the anode to the back of the cathode which can be blocked up by tilting it, shows this very nicely.

As regards the electrolytic discharge, this can only take place when the gas is disassociated by heat or by a strong slope of potential. To the convective discharge the same remarks apply as to the convective discharge in gases. At ordinary pressure the only gases which allow a discharge to pass easily are helium, argon and possibly that unknown gas whose spectrum we see in the light of the aurora borealis. Helium, as shown by Ramsey, behaves at ordinary pressure much as air at low pressure, and a spark will jump through it for about thirty times the distance it will through air at the same pressure when the pressure of both approximates that of the atmosphere.

Having got rid of the theory which was necessary in order to give opportunity to condense later, and which has led me to wonder if it were ever possible to find the pleasing mean between the conciseness of the Carpenter and the discursiveness of the walrus, we shall take up the practical part of the subject.

HIGH RESISTANCE INSULATION.

In laboratory apparatus in many cases, for instance with electrometers and resistance boxes, we need as high ohmic resistance as it is possible to get. Here however we are met by the fact that the two substances most commonly used, i. e., hard rubber and glass, are among the poorest insulators known for this class of work.

Rubber is very objectionable from the fact that whilst it presents a nice bright appearance when new, it contains sulphur and is very easily oxidized, especially when exposed to light. A film of sulphuric acid is thus formed on the surface, and if the tongue be applied to a piece of rubber which has been in use for some time the taste of the acid is very strong. I have seen the top of a Wheatstone bridge, supposed to be capable of measuring accurately to one part in 5,000, in which the total length exposed to leakage, divided by the average distance between which leakage could take place and the average voltage was only .008, with the top so acid that the tongue could hardly be allowed to touch it.

As a rule it is very hard to remedy this; rubbing the surface does no good as the acid extends in to some distance. Rubbing with cigar ashes is advocated by some, but I should fancy it would be almost impossible to remove the last traces of alkali. The method used by the writer is to steep the rubber in warm 10 per cent. caustic soda, then in warm distilled water frequently renewed, then drying in the dark quickly and rubbing with pure paraffin, treated as described under paraffin, then polished while

warm. This does good for a time, until the paraffin takes up dust.

For rods, a good way is to treat as above and coat half an inch thick with paraffin; then run over the rod with a wooden die and cut a thread in the paraffin. Run over the thread about once a month, and good results will be obtained.

With bridges, however, it is impossible to remove the top, and the only thing that can be done is to keep them covered up from light.

Rubber has also one other disadvantage, in that it does not show dirt, and where rubber comes in contact with copper it is apt to rot.

Glass is very bad, because the alkali in it has a great affinity for moisture. The alkali is slightly soluble, and hence it is the custom with analytical chemists to boil all beakers used in exact work for several days before using, so as to get the soluble alkali and silica out of them. When possible this should be done with the glass of electrical apparatus. Another very serious trouble is that the angle of contact between water and glass is zero, so that when a drop of water is placed in the middle of a pane of clean glass it immediately spreads all over it in a thin film. This method is used by chemists to determine when a glass is clean. Nothing much can be done with glass but to keep it dry. Sulphuric acid is generally used, but it sometimes, if allowed to get dust in it, gives off vapors which condense on the sides of the apparatus. This, however, does not often happen.

Evidently we need some substance of high ohmic resistance and one which water will not wet. Boys, who has earned the thanks of electricians for his happy discovery of an almost perfectly elastic fiber, has given us also, as he himself has pointed out, such an insulator in quartz. Dip a thread of glass in water and lay it between the knob of a charged electrometer and the ground, and the leaves close almost at once, the whole fiber being covered with a film of water. Treat a quartz fiber similarly and the water slides off it, or remains in little drops each separate from its fellow, and the insulator is apparently as good as the air itself.

Quartz should therefore be used as much as possible in electrical instrument work. It can be melted in a powerful gas flame furnace, and though it can never be melted down free from small bubbles, these make no difference except in appearance. It is however possible to obtain glass which contains no alkali and resembles quartz in that it is not wet by water. Such a substance is Faraday's borate of lead glass, as he himself points out. This is however too brittle for most work, but by an admixture with silica a glass could no doubt be made which would be perfectly satisfactory. If some glass manufacturers would take up this question and furnish us such a material for electrical instruments, the greater part of the present annoyance met with in making delicate experiments would vanish. It would not leak, would show dirt, could be readily cleaned, and would be free from one of the great disadvantages of rubber, i. e., a large coefficient of expansion, which is always making trouble by bending terminals of resistance coils, thus changing their value and sometimes opening the circuit.

It is also probable that a fine grade of porcelain would be a great benefit to the electrical profession, if coated with a good non-alkaline glaze.

(To be continued.)

Electric Lighting of Mail Cars in Germany.

According to an item in the *Volkzeitung* of Cologne, 64 per cent. or 1,108 out of 1,723 mail cars on the North German railways are now provided with electric light, whereby a saving of \$17,500 per annum has been effected. In consequence of this all the new cars now being built (73 in number) will be furnished with this form of illumination. The success which has attended these experiments being so great, the Bavarian and Austrian postal authorities are now taking steps in the same direction.

BIOGRAPHY OF A PIECE OF COPPER WIRE.*

BY CHANNING T. GAGE.

I desire to give you as briefly as possible an outline of the various processes through which the Bare and Insulated Copper Wire of commerce passes from the crude natural condition to some of the numerous forms in which it becomes useful to man.

Copper occurs in this country in two distinct conditions. In Montana and Arizona there are enormous deposits of copper ore in the form of sulphides, oxides or carbonates, though it is believed the two latter are a result of the decomposition of the former. This ore seems to have been projected upward in a semi-fluid state from the interior of the earth, and through great fissures or cracks in the earth's crust, after violent volcanic action which had tilted the rocks from a horizontal to an angular or nearly perpendicular position.

The ores require a very complex system of treatment to eliminate impurities and reduce them to metallic copper.

The second class of copper ores, found on the south shore of Lake Superior, constitute the only natural deposit of ore in the world containing pure metallic copper, free from all chemical impurities. There we find the ore in all forms and sizes, from particles as fine as flour to masses weighing hundreds of tons. From the Phoenix mine there was taken out a single mass weighing 50 tons.

The Arizona ore is the richest of any produced in this country, containing about 10 per cent. of copper; that in Montana contains about 7 per cent., while the conglomerate rock of Lake Superior contains from 1 to 4 per cent, and the amygdaloid rock from $\frac{1}{2}$ to 1 per cent. The greater expense involved in reducing and purifying the western ores practically balances their greater richness, so that the Lake Superior mines are able to produce the purest and cheapest copper in the world.

The Lake Superior copper deposits exist in the greatest abundance on that geological freak, Keweenaw Point, jutting out into the waters of the lake for about sixty miles in a northeasterly direction from the upper peninsula of Michigan. Here we find, extending nearly the entire length of the peninsula, outcroppings of copper-bearing rock, and the same strata have been traced far to the southwest through Michigan and Wisconsin. Copper ore occurs in two distinct forms in these parallel veins on Keweenaw Point: first, the so-called "ash-beds" or amygdaloid ore. In this the containing rock is of a soft, easily crushed material, of igneous origin, somewhat similar to lava, and in the porous cells of which the metallic copper is deposited in fine particles. This ore is easily worked, and, as in the Atlantic mine, can be made to pay well even when containing but $\frac{1}{2}$ of 1 per cent. of metallic copper; second, the conglomerate beds, in which the great fissures in the original rocks were filled with a sort of pudding-stone in which the cementing material has been partially displaced by metallic copper, tough and fibrous, binding together the pebbles and stones in masses almost impossible to crush.

Geologists differ somewhat as to the exact process by which this metallic copper was deposited, but many think that these fissures were originally filled with lava in the one case, and the conglomerate mixture in the other, by the action of intense heat and pressure from below. This cooled and subsequently, through a period of time possibly extending through ages, a solution of some copper salt gradually percolated through the fissures and, by a sort of electro-chemical action, deposited metallic copper in place of the original cementing material. Thus we find in the conglomerate veins copper in every conceivable form—in little nuggets, in thin leaves and threads, and in great irregular jagged masses.

For the purpose of this paper I will consider that our piece of copper wire originally formed a part of one of these masses, and was taken from the famous Calumet & Hecla mine.

There is positive evidence that the copper deposits were once worked by aboriginal miners, long before the period of the present race of American Indians.

It is stated that on the site of the Calumet & Hecla mine an Irishman had located his cabin, and one day his pig in exploring for edible roots accidentally tumbled into one of these ancient excavations. On getting the pig out, it was found to be well covered with a green mud, giving evidence of the presence of copper ore. The mud and rubbish were cleared away and a fine deposit of rich conglomerate rock was uncovered.

These deposits occur in so-called "chimneys" or strata of copper-bearing rock, alternating with strata of non-metallic rock. In this mine the "chimney" is about 13 feet in thickness and extends a distance of nearly three miles, of equal richness, and all controlled by this company. They had in 1891 seventeen shafts, following the dip of the vein at an angle of about 37 degrees to a depth of 3,800 feet. Some of these shafts are down over a mile.

Their latest shaft, recently completed and called the Whiting mine, has three compartments, two for hoisting rock and one for pipes, wires, etc. This shaft extends down vertically 5,500 feet, tapping the vein of ore at a point nearly 7,000 feet from the surface of the ground measured on the dip of the vein. Through this vertical shaft, steel hoisting ropes $2\frac{1}{2}$ " in diameter lift to the surface 20,000 lbs. of ore at a time. At this great depth the ore shows no sign of failing in quality or quantity, and to secure it becomes only a question of expense in hoisting it to the surface.

After the ore has been removed from the mine, and to a certain extent sorted, it is sent to the stamp mills where immense stamps crush it to small particles; large quantities of running water wash away most of the pulverized rock, the heavier copper settling to the bottom. This residue contains from 40 to 50 per cent of copper and is next sent to the smelter. There it is placed in a large reverberatory furnace in ten ton charges. By treatment with the proper flux and the intense heat of the furnace, the last vestige of rock and sand is removed, and the pure metallic copper is cast into ingots weighing from 250 to 300 lbs. each. These ingots are then shipped to the numerous wire mills and enter on the final process of conversion into wire.

At the wire mills the ingots are pushed into one end of a furnace and gradually brought to a white heat by the time they reach the other end. There a workman reaches in with a pair of immense swinging tongs, and starts one of these ingots down the incline and through the first pair of rolls, by which it is somewhat reduced in size and increased in length. Other pairs of rolls are in line just ahead, and the hot ingot passes rapidly through these until it is reduced to the appearance of a long fiery snake writhing and coiling about the great iron floors, yet guided through the proper openings by hands that are quick and sure. After passing the last roll it finally shoots at lightning speed into a revolving reel, into which it is coiled, then removed and hung up to cool. It is now a "rod" about $\frac{3}{8}$ inch in diameter, and the coil is known in the mill as a "bundle of rods." It is covered with a coating of black copper oxide, and in this condition looks like iron wire and must be cleaned. It is dipped in an acid bath, where the oxide is dissolved and the bundle comes out clean, bright, reddish-yellow copper. This is thoroughly washed and goes to the drawing room. Here one end is tapered and passed through a "die" or block of steel with a tapering hole in it; the end is fastened to a revolving drum and the wire drawn through the die and reeled on the drum. This operation is repeated, each time reducing the size and lengthening the wire, until the desired size is reached. This also thoroughly hardens the wire,

and makes what we call "hard drawn" copper, such as trolley and telephone wire.

For further drawing, or to make "soft drawn" copper, the coils are annealed or subjected to a high temperature for a certain length of time, and, after cooling, the copper is again soft and pliable. This drawing process may be continued until our original ingot, about 3 feet long, has been lengthened to a piece of No. 36 telephone magnet wire 750 miles in length.

These finer sizes are drawn by specially arranged machinery through dies made from the hardest of precious stones. It is possible by this means to produce an almost invisible wire, 1-1000 of an inch in diameter.

I have now carried the story of this piece of wire from its bed near the waters of Lake Superior to the form in which it can be used for many purposes, while bare, but there remains now to describe some of the numerous coverings or garments with which we will dress it in order to make it a more useful member to society.

First we will take the simple magnet wire—just a little round wire with a half-dozen parallel threads of cotton wound around it. Remember the great cotton plantations in the South, with the negroes cultivating and picking it. The cotton balls go to the gin where the seeds are separated, then go to the baling press, and then to the mammoth mills in New England where the white threads are spun out by automatic machinery.

In the wire mill this thread is wound on special spools, and these are in turn swung around and around our piece of copper wire, held firmly in place, until a beautifully smooth white covering just hides the wire from sight. One layer of cotton makes our "single cotton covered" magnet wire, and a second set of spools, following the first, winds another set of threads in the opposite direction and we have "double cotton covered" magnet wire.

Now bring from China the choicest product of her silkworms, spun into threads of finest quality, and putting this through the same process we have "silk covered" magnet wire, which you all know is such an important factor in telephone construction.

Think for a moment also of what might be the present development (or lack of it) of all the varieties of electrical machinery without magnet wire—generators, motors, transformers, voltmeters, ammeters, wattmeters, telephone and telegraph instruments, electric bells and alarms, arc lamps, etc., etc.

When Prof. Morse made his first experiments in telegraphy he secured a great length of wire in his laboratory by carrying it around the room back and forth on pegs, and his crude magnet was made by coating a piece of horseshoe-shaped iron with varnish and winding this with bare copper wire, the turns spaced just far enough apart to prevent touching. In the next electro-magnets, made by his partner, Alfred Vail, they used the only covered wire then known, viz., that used by milliners for stiffening hat and bonnet rims.

Now, step over into the oil fields of Pennsylvania and see the great tanks, full of black, "fragrant" crude oil; follow it to the refinery and watch the process of distillation and cleaning, until, as one product, you see a clear white, semi-transparent substance called paraffin, nearly impervious to water yet easily melted. Wind two layers of heavy cotton over a small wire, at the same time saturating it thoroughly with this warm paraffin, and you have the common "annunciator" wire, with the aid of which half the doorbells in the city are made to jingle at the push of a button.

"Office" wire is made of the same materials, but the cotton is braided on instead of being wound, and is made heavier.

Next we will journey to distant Poland and bring back some of that peculiar bituminous deposit called mineral wax or ozokerite, and, compounding it with other suitable materials, we will thoroughly saturate the two or three cotton braids which we have woven

* Paper read before the Chicago Electrical Association, March 18, 1898.

on another piece of wire and we will have the well-known "weatherproof" wire, of which immense quantities are now used for the outside lines of electric light and street railway plants. It is also superseding annunciator wire for interior bell and signal work.

Now travel with me once more to still another foreign land, and deep in the forests of South America we will find the wonderful india-rubber tree. Watch a swarthy native as he slashes into the bark with his knife, and there slowly oozes out a milky white fluid which he deftly catches in a rude basin. This is allowed to stand until upon its surface rises a creamy layer, which he gathers on a clay ball attached to the end of a stick and dries over a fire of leaves and twigs. This rough ball gradually increases in size by repeated dippings and is changed by the action of smoke and atmosphere to a dark red color, and after removing the clay center by breaking in pieces is finally sent off to the market as Para rubber. This is also known as caoutchouc and comes to us from the forests in all stages of impurity, often mixed with leaves and sand, or even pebbles, which become quite valuable when paid for at the rate of \$1.50 per pound.

The modern method of collecting the caoutchouc is to mix an equal quantity of water with the milky juice, and the cream then separates rapidly and completely. This is skimmed off and worked into a solid white mass by kneading and rolling. This may be sent to market in this form, or may be cut into thin disks and dried in the air, which changes it to a dark brown color by oxidation.

This brings us to the subject of rubber covered wire, a product which has during the last few years assisted greatly in the progress of electrical development. When we stop to think of it, is it not one of the wonderful things to consider in nature that this one material possesses the peculiar properties necessary for electrical uses, viz., a perfect insulator, thoroughly flexible, yet capable of receiving treatment that will harden it almost to the texture of ivory and still retain its wonderful insulating properties? The pure rubber would be almost valueless for many purposes except for this property of being hardened or "vulcanized" by the action of sulphur and heat. That was a wonderful discovery of Mr. Goodyear, which, though called accidental, must have been a part of the Creator's plan for the development of our modern civilization!

Now comes in play the art of the maker of rubber-insulated wire. Pure rubber used as an insulator gradually deteriorates and loses its insulating qualities, therefore he skillfully mingles with it various materials in just the right proportion, and the mixture is then applied to the wire (which has previously been well tinned) with the aid of specially designed machinery, and is then taken to the vulcanizing ovens, where just the necessary degree of heat is applied and the resulting product is an insulating covering for the wire which will maintain its value as an insulator for many years without change.

Now, taking this plain rubber-covered wire as a basis, look for a moment at its various uses. Covered with a cotton braid, usually saturated with a protective compound, we have the ordinary wire for interior electric light work. Again, this piece of copper wire may be made up of many fine wires, twisted together, making what is called a "strand," to secure greater flexibility. This may be wound with a single layer of cotton, then a thin coating of the rubber compound, not vulcanized, and an outer coating of bright colored cotton braid, and two of these twisted together form the ordinary "commercial lamp cord." This is now being superseded very largely by a similar product made with vulcanized rubber.

We will now take another length of the plain rubber-insulated wire, wind about it spirally a coating of adhesive tape, and pass it slowly through the lead press. By this machine a smooth uniform coating of lead is placed over the tape, making the well-known

"lead-encased cables" used so largely for underground service. Pure lead is too soft to withstand the friction of drawing the cable into ducts, so two or three per cent. of tin is added to the lead, which hardens it somewhat, but not enough to permit cracking when bent. This lead covering acts as a mechanical protection to the rubber and adds very materially to its life.

Another class of cables are made in which the rubber is replaced by a saturated paper insulation. These cables have a very high insulation resistance as long as the lead covering remains intact, but as soon as the lead becomes perforated from any cause, mechanical, chemical or electrical, they must be replaced. For underground telephone lines the paper-insulated cables have a special value and are extensively used in all the large cities. Usually 50, 75 or 100 pairs of wires are bunched together and a lead casing is placed over all.

For submarine cables, crossing rivers, harbors, etc., the lead-encased rubber cable is covered with a layer of jute, and then an armor of galvanized iron wires is laid on spirally for protection against boats and anchors.

For ocean cables there is used as an insulator a gummy material known as gutta-percha. It is gathered from tropical trees, similar to caoutchouc, but it has certain properties from an electrical standpoint making it peculiarly adapted for use in submarine work. These cables are not lead-encased, but usually have three layers of armoring laid on in reverse directions and well juted between.

The first submarine cable ever laid was in Calcutta in 1839, across the Hugli river; the copper wire was insulated with cotton thread, pitch and tar, and did very good service for a long time. From that small beginning, submarine cables have increased in numbers until they form a veritable network encircling the earth in all directions.

Thus hurriedly have I traced the story of our piece of copper wire and its coverings, realizing that I have but just touched on a few salient features, leaving much of interest that would repay further study.

NEW SYSTEM OF ELECTRIC TRACTION BY ALTERNATING AND DIRECT CURRENTS.*

BY C. JORIGNOT.

During the last few years alternating currents have become of great value as a means of transmitting power over long distances. Besides the advantages that they present through high voltage easily obtained, which allows of the weight of copper in a conductor being greatly reduced, the compact and substantial qualities possessed by polyphase motors have just brought them into favor.

For electric traction however, and especially railroad work, few practical alternating current systems have been devised. This is due not only to the nature of the motors which does not allow of their being satisfactorily operated at variable speed, but owing to the greater number of conductors which it is necessary to stretch along the line and which greatly complicate installations.

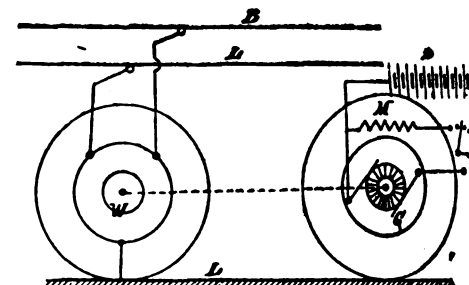
M. Déri, giving up the idea of transferring direct current to alternating by means of rotary transformers located at various sub-stations along the line of a road, which is by no means economical and requires constant supervision, suggests the use of storage batteries in combination with alternating currents. He thus simultaneously makes use of the qualities possessed by direct-current motors and of motors operated by an alternating current.

The larger part of the energy utilized is directly furnished by alternating currents in the ordinary manner by means of conductors situated along the line; these overhead wires could however be done away with at points where it would be difficult to erect them, namely, at crossings, tunnels, etc.

* Translated for *ELECTRICITY* from *La Vie Scientifique*, Paris.

The cars or engines are equipped both with alternating-current motors, either single phase or poly-phase, and with direct current motors which can be run as generators. The direct and alternating current motors may be placed on the same vehicle side by side or on different axles. The line conductors feed the alternating-current motors, while the storage batteries are attached to the motors operated by direct current. When the amount of alternating current is greater than is necessary for the operation of the train, the surplus energy could be utilized in charging the batteries through the continuous-current motors. In the reverse case, the direct current motors would receive the surplus current from the storage batteries which would assist in operating the alternating-current motors.

At points along the line where it would be found difficult to place conductors, the batteries would



Electric traction by means of alternating and direct currents. General arrangement.

furnish the necessary current for operating until contact could again be made with the line wire.

This system would allow of single-phase currents being employed, which, although objectionable in starting, are advantageous in operating at a given rate of speed.

In this manner the economical advantages of stationary batteries is made use of; besides, the power drawn from the central stations, being almost constant, permits of their being operated most economically. The accompanying illustration shows the general arrangement of the apparatus either on a car or an engine.

L L L are the conductors for triphase alternating currents, the rails and earth taking the place of one conductor. G is the continuous current dynamo, D the storage batteries, and M the exciting coils provided with a rheostat.

The Northwestern Electrical Association.

The committee to whom was referred the matter of this Association's 1898 summer meeting has adopted the plan suggested at the recent Annual Convention, of taking steamer from Chicago to Duluth, holding short daily sessions on the boat, and ending with business and social sessions at Duluth and a reception and banquet at Superior. Following is the proposed itinerary:

Leave Chicago on steamer Northwest at noon on Friday, June 10, touching at Milwaukee for delegates who may find it convenient to join the party there, thence proceeding to Mackinac Island for a short stop, enabling a brief inspection of that celebrated resort; thence to Sault Ste. Marie and through the Government locks and ship canal; thence to Hancock and Houghton to visit the famous Calumet and Hecla copper mines; thence, on the largest body of fresh water on the globe, past the "Pictured Rocks" and Apostle Islands to Duluth, "the Zenith City of the Unsalted Seas." Two days' stay in Duluth and Superior, then home by rail. The mayors and common councils, the boards of trade and commercial clubs of both cities have united in a cordial invitation to the Association and its guests, and are now preparing for their welcome on arrival and entertainment during the visit. Special invitations from these cities and from this Association will be personally delivered to Mr. Edison, Mr. Tesla, Mr. Thomson, Mr. Brush, Mr. Wood and other distinguished electricians.

A "Convention hour" each day on the boat will

be devoted to discussions by practical men on topics of practical interest to owners and operators of central station plants. It is intended to make the trip a valuable as well as a delightful one to all on board. The Northwest, specially chartered for the occasion, is the largest and finest steamer on the lakes, and is surpassed by no ocean vessel in stannohness and elegance of appointments. She carries a fine orchestra, and has every modern improvement known to passenger boat construction, including an extensive and complete electrical equipment.

LONDON NOTES.

[From our London Correspondent.]

New Municipal Lighting Plant at Torquay.

There has just been inaugurated by the Torquay Town Council a \$110,000 municipal electric lighting installation. The generating station contains three Babcock & Wilcox water tube boilers supplying steam for three 150 HP. Willans & Robinson engines which are coupled to three 125 KW. alternators. There are three Ferranti rectifiers for arc lighting. The plant is capable of supplying seventy 1,600 CP. arc lamps and 12,000 8 CP. incandescents. The current is transformed down to 200 volts at sub-stations. Current is charged for at 7d. per unit for the first hour and 3d. per hour after.

Municipal Telephony.

There has been quite a craze in progress during the past few months in England for municipalities to work their own telephone systems. This is of course the outcome of the very inefficient service given by the National Telephone Company which is hand in hand with the General Post Office, and has practically a monopoly of the whole of the United Kingdom. The Glasgow Corporation and various other municipal bodies have been applying to the Postmaster-General for municipal licenses, but these have now been refused. The feeling all over the country is so strained against the National Telephone Company that it is difficult to say what may be the next step—especially in view of the Postmaster-General's refusal to grant licenses. There are numerous and important objections to municipal telephone exchanges, but the country is demanding an alteration for the better, whatever the steps taken to effect that alteration may be.

A New Technical Institute.

On March 18 the Lord Mayor of London officially opened a new technical institute which has been built and splendidly equipped in the Clerkenwell District of London. The site upon which the buildings stand was presented by the Marquis of Northampton (value £25,000), hence the Institute is known as the Northampton Institute. In addition to numerous workshops of a general kind, there is a boiler house containing two 100 HP. boilers—one of the Lancashire type and the other a water-tube type—for the purpose of affording students an opportunity of making comparative tests of the different performances of the boilers under different conditions of working and with different kinds of fuels. There is a well equipped power room for the joint use of the mechanical and electrical departments, and from the plant in position here power is supplied for the various workshops and laboratories. There is an instrument workshop, senior and junior physical laboratories, a heavy electrical engineering laboratory, and a laboratory for electro-chemistry. Altogether there are seventeen large workshops and seven laboratories, as well as a great hall and a variety of social and recreative departments. The total cost of the buildings and equipment has been from £50,000 to £90,000.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to **ELECTRICITY**.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of **ELECTRICITY**, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of **ELECTRICITY** duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of **ELECTRICITY**, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

Congressional Notes.

An appropriation of \$1,500 has been asked for the construction of a telephone line from the United States light-house at Table Bluff, Cal., to connect with the general telephone system at Salmon Creek, Humboldt County, Cal.

An amendment has been introduced for the annulment of an act granting right to the Des Moines Rapid Power Company to construct and operate a power station on the Mississippi River provided the work is not commenced within four years from February 24, 1898.

The act granting extension of time for the com-

mencement and completion of a wagon and motor bridge across the Missouri River at St. Charles, Mo., from June 3, 1898, and June 3, 1902, respectively, has passed the Senate.

Proposals Invited for Electric Elevators.

Sealed proposals are being invited until April 14 for furnishing and erecting in the Government Printing Office at Washington seven electric elevators. Detailed specifications and regulations with which bidders must comply may be obtained by addressing F. W. Palmer, Public Printer, Washington, D. C.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Appellate Division of the Supreme Court of New York on the 25th ult. affirmed a judgment awarding damages to W. Preston Hix on a verdict given in his favor on the second trial of his suit against the Edison Electric Light Company, upon a contract of employment to promote and organize for the benefit of the defendants a company to be known as the Edison Electric Light Company of Philadelphia. Mr. Hix received as compensation for his services 15 per cent. of the \$1,000,000 of stock of the Philadelphia corporation, but he claimed to be entitled to one-third of three separate issues of shares subsequently made by which the capital stock of the Philadelphia Company was increased, and the Appellate Division sustains the claim.

A bill in equity has been filed at Columbia, Pa., by the Lancaster & Susquehanna Turnpike Road Company, the Lancaster & Columbia Railway Company and William B. Given, receiver of the Pennsylvania Traction Company, against the Columbia Telephone Company. In the bill filed the plaintiffs state that the defendant company asserts that it has the power, without making compensation, to erect its poles and place telephone wires on them, on the roadbed of the Lancaster & Susquehanna Turnpike Company, which was leased to the other plaintiff. The plaintiffs say the telephone company's poles will interfere with the operation of the electric railway and pray for an injunction to prevent the defendants from erecting the poles on their roadbed.

The decision of Justice White of Buffalo relieving the village of Le Roy, N. Y., from the obligation to buy the plants of the Le Roy Gaslight Company was received with satisfaction by the taxpayers. The village acquired the plants (gas and electric) by condemnation proceedings and it now turns out that the ballot upon which the question of establishing a municipal lighting system for the village was submitted to the taxpayers was illegal. The water commissioners took possession of the plants on December 1st. By operating them since then it has been shown that it is cheaper for the village to buy its light of a company than to own the plant itself. Therefore the decision is looked upon as a deliverance from a financial burden.

In the county clerk's office in Saratoga, N. Y., on Wednesday last, was entered a judgment for \$280,686.30, with interest from January 25, 1898, in favor of the New York Security & Trust Company and against the Saratoga Gas & Electric Light Company. It is directed that the proceeds of the sale of the concern be divided equally and ratably between the holders of the 300 bonds in the mortgage foreclosed.

The report of Receiver J. L. Bradford for the Indiana Traction Company (Clodfelter) was filed last week in the Superior Court at Marion, Ind. The statement shows the receiver to be charged with \$42,831.81; that the property at public sale brought \$35,619.55, leaving a balance of \$7,212.26. He has \$3,061.81 in cash, the balance in notes with approved security. Claims yet to pay amount to \$7,212.26. These are under three classifications. A claims amount to \$4,951.21, B claims \$368.11 and C claims are more than \$3,000 in the aggregate. The claims will be paid in the lettered order.

William R. Cole has brought suit against the Detroit Telephone Co. making the Detroit Switch.

board & Telephone Construction Co. correspondent, and asks damages of \$400,000. Mr. Cole claims that he is the inventor of the switchboard used by the company which enables them to evade Bell patents, and that he was ignored in the formation of the Switchboard Company and his invention credited to Thomas F. Ahern.

On the 25th ult. at Salt Lake City, Utah, Judge Marshall entered a decree against the Salt Lake & Ogden Gas & Electric Light Company and the Union Light & Power Company, in the foreclosure suit brought by the Farmers' Loan & Trust Company. Under the decree, the sale is ordered of all the first named defendant's property and rights in Ogden and Salt Lake, including the manufacturing and distributing plants. The mortgaged property is to be sold in its entirety, and the defendant is accorded no right of redemption. The debt is due on interest coupons amounting to \$45,000 due July 1, 1897, and \$45,000 on coupons due January 1, 1898, and a principal of \$1,500,000, making a total indebtedness of \$1,613,610. The defendants are given twenty days in which to pay the amount, and in case of default the whole mortgaged property will be sold. The decree appoints S. H. Lewis master commissioner.

A jury at Tacoma, Wash., on the 24th ult., decided that the sale of the Payallup Waterworks by the Tacoma Light & Water Company to the Tacoma Gas & Electric Light Company was a fraudulent one and that the city is entitled to levy on the waterworks under the judgment for \$800,000 given in favor of the city in its suit against the Tacoma Light & Water Company last August.

In the suit at San Francisco of the California Electric Company against the California Safe Deposit Company, as executor, and Laura Roe, executrix of the estate of the late George H. Roe, Judge Slack, on the 16th ult. found for the plaintiff for \$71,324 24. George H. Roe was a director in the plaintiff company at the time of a sale of its property for \$1,000,000. On the sale a cash commission of \$100,000 was paid, and it subsequently developed that Roe received \$50,000, being one-half of the commission. After his death the California Electric Company sued the estate to recover Roe's share of the commission, and about four months ago a jury returned a verdict in favor of the plaintiff, leaving the amount of the judgment to be ascertained and determined by the court.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Allentown, Pa.—The franchise of the Allentown & Reading Electric Railway Company for the construction of a trolley line from this city to Kutztown has been sold to a syndicate which will apply to the State Department for a new charter. The new concern will be known as the Allentown & Kutztown Traction Company.

Baltimore, Md.—Under the new charter adopted by this city no franchise can be granted to a street railway until it is advertised and sold to the highest bidder, and then the privilege is only a license for a limited term. The city may, after the expiration of the license, run the street railways or lease them.

Battle Creek, Mich.—The contract for building the electric railway from this city to Gull Lake and Kalamazoo has been let to the New York Construction Company of New York City. The construction company begins work on the line on the 10th inst. and is to have it completed in 90 days.

Chattanooga, Tenn.—The electric railroad from Lookout Inn to the site of the old Lookout Mountain house is expected to be in operation by May 1.

Cleveland, O.—The injunction recently granted to prevent the Cleveland, Medina & Southern Electric Railway from taking its proposed route through Linnendale was dissolved by Judge Stone on Tuesday of last week. The judge said electric lines have as much right on country roads in these progressive days as on city streets.

Detroit, Mich.—During the past year Patrick M. Kinsella of Livonia has been organizing a company to build an electric road between Detroit and Ann Arbor. His plan was to interest farmers along the route as stockholders, and he now reports that within a few weeks the company will be organized, with \$500,000 capital, under the name of the Detroit, Pike's Peak & Ann Arbor Railway Company. The line will be 50 miles long

and the fare one cent a mile. A power house will be built at Pike's Peak, where there is a fine water power.

Elizabeth, N. J.—Governor Voorhees having signed the Squires trolley bill enables the board of freeholders of this county to sell outright the trolley franchise from Elizabeth to Plainfield for a term of seventy-five years.

Frankfort, N. Y.—Highway Commissioner Wetmore has signed the franchise granting to the Frankfort & Utica Railway Company the right to build an electric trolley road over and along the highway from the westerly line of the corporation of the village of Frankfort to the Oneida county line. By the terms of the franchise the road is to be completed by December 1.

Gallion, O.—William E. Haycox, of Mansfield, O., and associates have been granted the right to construct and operate an electric street railroad in this city. The grant permits the carrying of freight, baggage and express matter as well as passengers.

Independence, Va.—A public meeting is to be held here this week in the interest of the proposed electric railroad to run from Chestnut Yards, on the North Carolina Division of the Norfolk & Western road, to Grant post-office, by the way of the Mouth of Wilson, in Grayson county, a distance of some forty miles.

Jersey City, N. J.—As a result of the lease of the Consolidated Traction Company to the North Jersey Railway Company, which was consummated on the 28th ult., the latter company will start out at once to develop the traction lines and to extend them throughout Northern New Jersey. A network of trolley lines is to be established until communication will be afforded between most of the various towns in the northern part of the State. The new company is to have a capital stock of about \$25,000,000.

Milford, Ia.—There is strong talk here of building an electric railway to connect Spirit Lake, Milford and Arnold's Park. The proposition of a Peoria, Ill., capitalist to build the road and put in an electric lighting plant is received with much favor by the business men of Milford.

Milford, Mass.—The committee on street railways of the Legislature reported favorably a bill incorporating the Milford, Attleboro & Woonsocket Street Railway. The original petition was for the incorporation of the Worcester, Milford, Attleboro & Woonsocket Street Railway, but the strength of the remonstrance of the Grafton & Union Company, whose line between Grafton and Milford the proposed railway was to parallel, led the committee to strike out the section between Worcester, Grafton and Milford.

Montclair, N. J.—The town council has come to an agreement with the North Jersey Street Railway Company to allow trolley cars to run through the streets of the town. The efforts of the North Jersey Company to get a franchise from the town began in July, 1894, and the discussions in the council relative to the matter if printed would fill a volume as large as the Bible.

New York.—The question of rapid transit across the city above 57th street was discussed a few nights ago by the East Side Progressive Association, and the general opinion was that electric surface lines on the depressed streets that cross the Park would give the most satisfactory transit. The matter will be taken up by the proper authorities.

New Brunswick, N. J.—It is announced here that the New York & Philadelphia Traction Company and the Brunswick Traction Company, which have until recently fought each other aggressively for trolley franchises in Middlesex and Somerset Counties, have combined with the purpose of building several trolley lines from this city to Camden County. Edward Radcliff, secretary of the Brunswick Traction Company, and J. Blair MacAfee, vice president of the New York & Philadelphia Traction Company, are now working together to get rights of way for the towns of Burlington County. The Brunswick Traction Company now has lines connecting this city with Bound Brook, Metuchen, South River and Milltown, and will soon extend them to Perth Amboy. The New York & Philadelphia Traction Company is about to operate its line between Bound Brook and Somerville, a distance of five miles.

Pensacola, Fla.—Electric cars are now running on the street railway in this city.—It is expected that within six weeks Key West will have an electric line in operation.

Pittsburg, Pa.—The consolidation of the Homestead & Schenley Park, Homestead & Highland, Braddock & Homestead, and the White Traction Company of McKeesport has been completed. Improvements and extensions will be made.

St. Louis.—The suburban passenger business of all the steam railroads running out of this city shows an enormous decrease in earnings during the year 1897. The loss is due to the competition of the trolley lines that have been extended into the territory formerly occupied by the steam roads. The commutation business on the Missouri Pacific shows a decrease of 42 per cent. in the number of passengers carried; the average distance carried increased 23 per cent., the revenue decreasing over \$21,000, due to electric car competition. Other lines show similar decreases.

Trenton, N. J.—The Bergen trolley bill, which has been signed by Governor Voorhees, empowers boards of freeholders and similar bodies to sell franchises for street railway lines on county roads to the highest bidder provided the consent of the municipality is given, the term of such franchises to be 75 years.

Tremont, Mass.—Agitation for an electric road from Tremont to Plymouth is in the air. Arguments in favor of such a scheme are multiplying, and it is intimated that capital might be secured by the right party to push it. Such a road would command a passenger traffic of large proportions. It would complete a straight line from New Bedford, Fall River, Fairhaven, Cape Cod and southern Plymouth county towns to Plymouth.

Washington, D. C.—The House District Committee has voted to report favorably a bill to allow the Washington & Gettysburg Railway to enter the city of Washington.

Worcester, Mass.—The route of the proposed trolley line between Worcester and Danielson, Conn., parallels the Norwich division of the New England Railroad the entire distance, about thirty miles. The road as now planned will pass through Webster, Perryville, Wiltonville, North Grovesdale, Grovesdale, Mechanicville, Putnam, Ballouville, Attawansan, Dayville and Elmville. About ten miles of track will be in Massachusetts.

LIGHTING PLANTS.

Bradford, N. H.—At a special town meeting held here last week there was a unanimous vote in favor of putting in electric lights.

Clarion, Pa.—After a long struggle the borough council has decided to light the streets of this town with electricity.

Greenwood, S. C.—A contract has been closed which will give this place an electric system and waterworks. The plants are to be completed by September 1.

Kenosha, Wis.—The council has extended the franchise of the Electric Light Company from twenty to forty years.

Mansfield, Mass.—Governor Wolcott has signed the Barnard electric light bill, which permits the Mansfield Water District to furnish the town with electricity for lighting the streets and public buildings.

Medina, O.—A petition signed by nearly 400 of the best citizens, asking that the entire city be lighted by electricity, has been presented to the council. A few arc lights around the public square, run by business men, supply all the electric illumination the city at present enjoys.

Nashville, Tenn.—The Nashville, Chattanooga & St. Louis road is preparing to equip its engines with electric headlights, and with that end in view has already furnished one of the engines which make the run between Nashville and Atlanta with an electric headlight. The railroad men say the light is a great improvement on the old method.

Ortonville, Minn.—Arrangements for the establishment of waterworks and electric lighting plants in this city have been completed. The contract for furnishing the entire system was awarded to Patrick Doherty of St. Paul. The electric lighting plant will be furnished by the Fort Wayne Electric Corporation of Fort Wayne, Ind.

Piercetown, Ind.—The town council has decided to put in waterworks and an electric light plant as soon as possible.

Reno, Nev.—The city council will issue \$130,000 bonds to put in a new water system and \$20,000 for an electric light plant.

San Francisco, Cal.—W. B. Summerhayes, representing the Mutual Electric Light Company of this city, appeared recently before the street committee of the Supervisors and stated that his company if granted the same privileges as the San Francisco Gas & Electric Company would establish a plant and furnish light to the city at a saving of \$40,000 yearly, also serve the citizens with light at a reduction of 25 per cent. from the present cost. He said his company would put up a bond of \$100,000 as a guarantee.

Spring City, Pa.—Peter Vroman and W. A. Keffer, a committee of the borough council, will receive until May 2 proposals for lighting the streets with electricity for a term of one or five years. Specifications may be had by applying to the committee.

Superior, Wis.—Mayor Starkweather, who is up for re-election, announces himself in favor of municipal ownership of an electric light plant both for city and commercial lighting.

TRANSMISSION PLANTS.

Harper's Ferry, Va.—The Harper's Ferry Paper Company, owner of the Harper's Ferry water power on the Potomac River, has almost completed arrangements to turn one-fifth of its power into an electric generating plant which will represent 400 horse power.

Little Falls, N. Y.—The electric power plant on the East Canada Creek at Beardsley's Falls, five miles east of Little Falls, has been completed. The power station is located on the east side of the creek about 300 feet below a natural dam of solid rock, and the water is conveyed by sluiceways partly cut in the rock and partly of wooden construction to a steel tube through which it is conducted to the turbines. The capacity of the present plant, about 600 H.P., can be trebled at slight expense. Poles have been erected and wires strung to convey the power to St. Johnsville. Guy B. Beardsley, of East Creek, proprietor of the plant, is the originator of the enterprise.

Marysville, Cal.—The Yuba Power Company has completed the transmission line from its plant in the hills

above Brown's Valley to Marysville, and on the night of the 21st ult. a fine electric-light display was given here that created great enthusiasm. The power house of the company is about 23 miles from Marysville. It is situated at the head of what is known as Captain ravine, down which for 850 feet is laid the heavy steel pipe which leads the waters of the Brown's Valley irrigation canal to the Pelton wheels at the power-house. These wheels are buckled to and run the large electric generators, three in number, of 500 H.P. capacity each. The machines supply the current for the lights in Marysville and power for the mines at Brown's Valley. The fall from the ditch to the Pelton wheels is equivalent to a vertical fall of 293 feet, and the power produced is equivalent to 1,878 H.P. The company is figuring on extending its current to Wheatland, Smartsville, Woodland, Lincoln and other surrounding towns.

Toronto, Can.—The Niagara Falls Power Company is building a new power house on the Canadian side, and by November of next year expects to be able to supply all the power Toronto needs. To build a line for 10,000 H.P. from the Falls to this city would cost about \$1,000,000. The loss in transmission for this distance is estimated at 25 per cent.—that is to say, a current of 10,000 horse power would be reduced to 7,500 when it reached Toronto.

MANUFACTURING, ETC.

Jeannette, Pa.—The Keystone Telephone Supply Company of Pittsburgh will build its plant in this place. The company gets a cash bonus of \$10,000 and two acres of ground from the town. It agrees to operate the plant steadily for three years and will employ 200 hands.

COMPANY MATTERS.

Alton, Ill.—The Alton Railway & Illuminating Company's petition for the appointment of a receiver for the Alton Gas & Electric Light Company has been granted by Judge A. W. Hope, who appointed James Duncan receiver.

Oakland, Cal.—The street railroads owned and operated by the Realty Syndicate have been amalgamated and incorporated under the name of the Oakland Transit Company, with a capital stock of \$5,000,000. The directors are F. M. Smith, E. A. Heron, F. C. Havens, W. H. Martin, D. D. Harris, J. C. Winans and Charles R. Bishop.

Ottawa, Can.—The Hon. John Haggart, W. A. Allan, A. Charlevoix, Sir Sandford Fleming and R. G. Code of Ottawa are applying for incorporation as the Canadian Electric & Water Power Company of Ottawa, capital stock \$100,000, for the purpose of establishing waterworks and manufacturing electrical machinery and electricity for the purposes of light, heat and power in the cities and towns of Canada.

St. Louis, Mo.—The Central Traction bill, an amended form of the North and South ordinance vetoed by the mayor, has passed the House of Delegates and also by the council.

White Plains, N. Y.—An order issued by Justice William D. Dukey in the Supreme Court, dissolving the Tarrytown Electric Railway Company, with the company's consent, has been filed in the county clerk's office here. Thomas C. Preso is appointed receiver of the property of the corporation.

NOTES FROM A CORRESPONDENT.

Troy, N. Y.—In the case of a boy who was killed by being run over by a motor car March 23, the coroner's jury exonerated the motorman but condemned the fender now in use on the cars of the Troy city railway as practically useless.

Schenectady, N. Y.—The lecture of Mr. Steinmetz before the Historical and Art Society of Albany was postponed on account of the illness of the speaker.—Detective G. S. Docherty has captured a noted criminal, William Davis. It is strongly believed that Davis is implicated in the murder of George R. Blodgett, patent attorney for the General Electric Company. Mr. Blodgett was shot by a burglar December 3, and died two days later. A reward of \$5,000 was offered by the General Electric Company for the arrest and conviction of the murderer.

PERSONAL AND MISCELLANEA.

S. Percy Sellon, W. M. Morday and C. E. Hodgkin of London, Eng., representing the Brush Electric Company of England, visited the Westinghouse works at East Pittsburgh last week.

A Lebanon, O., newspaper complains of the electric street lights in that town. The editor says "it would be a good idea to have the electric light poles painted white. With such miserable street lights the people need to be protected from running against the poles."

Charles McNellis, aged 14 years, was instantly killed at Pittsburgh, Pa., recently by an electric current. He was playing with comrades on South Twenty-sixth street when one of them dared him to touch the crank on an arc light pole with a rusty hoop. McNellis said he would not "take the dare," and reaching on his tip toes succeeded in touching the crank. It was charged and sent a death shock through the boy.

New Orleans street-car conductors have a champion in a Northern woman, who entered a car and kicking off her muddy goloshes placed them beside her feet. To her great surprise the conductor produced a newspaper and with the air of a gallant gentleman asked that he

be permitted to wrap up the overshoes for her. He made a neat package, and now she says that New Orleans street-car conductors are the most polite she has ever met.

The Cincinnati "Post" states that H. P. Bradford, former manager of the Main street electric road, Cincinnati, has gone to the City of Mexico, where he will have charge of a system of railways now operated by horses and steam which are to be converted into electric lines. Several conductors and motormen of the Main street line went to Mexico with Bradford.

Charles W. McLean, whose death occurred lately in a hospital for incurables at Fordham, N. Y., was a former resident of Toledo, O., where he was well known as a promoter of several commercial enterprises. He introduced the electric railway into Toledo.

The power house of the Kansas University at Lawrence, Kan., was recently destroyed by fire. The machinery in the power house, comprising two fine engines, several dynamos, and all the machinery used in the mechanical work of the students of the electrical engineering department, as well as all the tools, was damaged beyond repair. The value placed on this machinery by Prof. Blake, the head of the department, is about \$12,000, and there was much other property lost.

During the year 1897, 385 carloads of slate were shipped from the station at Monson, Me. The slate business is yearly increasing. Eighty per cent. of the electrical appliances in England are American made, and Maine slate is used for them in great part. The Monson-Burmah Slate Company is busy on electrical work and is now furnishing slate for a great office building approaching completion in New York City. The order for this building calls for 1,800 pieces of slate for electrical appliances alone.

M. F. Halbert, in a letter published in the Baltimore "American" of the 28th ult., says: "In Glasgow, London, the Hague, and Amsterdam, horse cars are the means of locomotion. In Edinburgh there is an electric road scarcely worth mention, and one in Paris, running from the Madeleine to the tombs of the kings at St. Denis, which is outside the city limits, but the snail's pace at which the cars move makes them but a slight improvement on those drawn by horses. Brussels, that gem of a city, which has in fact been called a miniature Paris, is one of the few cities possessing electric cars that in equipment and management equal our own."

The Electro-Magnetic Concentrating Company, which formerly operated the Gray Eagle mine at Rowena, has moved its plant to Ward, Col. The plant consists of six 4 x 12 concentrating tables, steam power machinery and a dynamo. The mill will commence business about May 1, and will set the tables to running on slimes and waste that flow from the Utica and Binford mills. It will later branch out in other directions and do a general custom business of treating ore. The company officers are J. O. Dimmick, president; E. K. Woods, vice president, and L. Dimmick, secretary, all of whom are of Denver.

The United States Lighthouse Board gives notice that on June 1 the first order fixed white light in the southern tower of the Highlands of Navesink, entrance to New York harbor, will be permanently discontinued. There will be established in the tower, in place of the discontinued light, an electric light showing a white flash of about one tenth of a second duration every five seconds. The height of the local plane of the electric light above mean high water will be the same as that of the present light, 246 feet, and the light will be directly visible 22½ nautical miles in clear weather, with the observer's eye 15 feet above the sea. Under certain conditions the reflection of the light in the sky will be visible at a much greater distance.

Abner Cheney Goodell, a noted inventor, died at Salem, Mass., on the 27th ult., at the age of 93. He was born in North Orange, Mass., February 9, 1805, being the son of Zina and Johanna Goodell, who had thirteen children, four of whom lived to be over 90 years of age, and four over 80. Mr. Goodell was the great grandson of Robert Goodell, who was the original emigrant from Ipswich, Eng., and who sailed April 30, 1634. He was of an inventive turn of mind, and perfected the first printing press that printed on both sides in one operation. His inventions in this line became the foundation of the present Hoe press. The Boston "Advertiser," from which we collate the foregoing, states that in 1837 Mr. Goodell "went to Salem and worked on the first electric motor ever built, that designed by Dr. Charles Grafton Page, and which was run between Baltimore and Washington."

RECENT COMPANY ELECTIONS.

Citizens' Gas & Electric Company, Jacksonville, Fla.—President, S. B. Hubbard; secretary and treasurer, Lewis J. Carder; directors: S. B. Hubbard, W. A. McEluff, John Clark, A. D. Stevens, A. F. Perry and J. D. Lincoln. The only new director elected was Mr. Lincoln, who is of Plainville, Mass.

Delhi & Bloomville Electric Railroad Company, Delhi, N. Y.—President, George Adee; vice-president, R. P. Cornnack; secretary and treasurer, A. J. Corbin; general manager and superintendent of construction, B. C. Friel; chief engineer, W. B. Peters.

Edison Electric Illuminating Company, Altoona, Pa.—President, H. O. Dorn; vice-president, S. H. Smith; secretary, A. J. Anderson; treasurer, Henry Cryder; auditors: H. E. Ferguson and O. A. Wood; directors: S. H. Smith, A. J. Anderson, H. E. Ferguson, John Lloyd, H. C. Dorn and O. A. Wood.

Fall River Electric Lighting Company, Fall River, Mass.—President, F. S. Stevens; clerk, Owen Durfee; treasurer,

A. F. Dow; directors: Frank S. Stevens, John D. Flint, F. O. Dodge, Edw. and L. Anthony, O. M. Hawley, R. W. Bassett, J. K. Osborn, J. B. Hawley and Jerome C. Borden.

Laconia Electric Lighting Company, Laconia, N. H.—President, Dennis O'Shea; treasurer and clerk, Charles W. Tyler; general manager, John F. Merrill; auditors: John W. Ashman and Addison G. Cook; directors: Dennis O'Shea, John F. Merrill, Jefferson Gilbert, Albert G. Folsom, Frank P. Holt, Gardner Cook and Addison G. Cook.

Newtown Electric Light & Power Company, Newtown, Pa.—President, Ashbel W. Watson; vice-president, T. S. Kenderdine; secretary and superintendent, William M. Watson; treasurer, Robert Kenderdine; directors: Ashbel W. Watson, George O. Worrell, T. S. Kenderdine, Edward H. Buckman, George C. Blackau, William M. Watson and Robert Kenderdine.

Petersburg Electric Railway Company, Petersburg, Va.—President, Edward C. White of New York; vice-president, Lloyd Nash of Westport, Conn.; secretary and treasurer, W. P. McKee of Petersburg; directors: the officers and Alexander Hamilton of Petersburg.

Scottdale, Everson & Broad Ford Street Railway Company, Scottdale, Pa.—President, John P. Breunnen; treasurer, W. N. Porter; secretary, John R. Byrne; directors: E. H. Reid, W. F. Sadler, A. Reader Partridge, O. De Witt Bassler, John R. Byrne, John P. Breunnen and H. J. Byrne.

Trenton Gas & Electric Power Company (reorganized), Trenton, N. J.—Directors: G. W. Gardner, W. H. McKinley, H. B. Stanley, Alfred Gregory, H. M. Beardsley, P. E. Parrott.

COMMERCIAL PARAGRAPHS.

The Orient Electrical Company of Youngstown, O., the well-known manufacturers of High Grade Incandescent Lamps, state that their trade during the past season has been very much larger than during corresponding months of the year before and that they are receiving large orders for their Strictly High Grade Anti-Trust Lamps. They justly attribute this to the fact that their lamps are strictly first class in every particular and are sold at less than Trust prices. The well-known quality of the product this firm turns out needs no comment.

Educate Your Bowels With Cascarets.
Candy Cathartic, cure constipation forever.
10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

Removal Notice.

The Pennsylvania Steel Company beg to announce that in future their Boston office will be in Rooms 11 and 12 Mason Building, 70 Kilby street, corner of Milk street.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

The rapid increase in the number of independent telephone exchanges has made the telephone supply business a very important item in the business of all the electrical supply companies. One of the items used by the telephone companies for which there has been quite a large demand is that of rubber-covered telephone cables. The Parante Telephone Cables which are being sold in the West by the Electric Appliance Company, Chicago, are securing a very high reputation among telephone people. The Electric Appliance Company are in a position to make the most prompt delivery on these telephone cables for the reason that they represent the only rubber-covered wire factory located in the West. The Electric Appliance Company are thus enabled to ship any ordinary order for special telephone cables from their Indiana factory within a very few days after the receipt of the same, which makes an unusually prompt delivery for this class of material. The Electric Appliance Company are always pleased to submit samples at any time of what they are producing in this line.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

INCORPORATIONS.

The Illinois Electric Company, Chicago—to deal in electrical appliances. Capital stock, \$20,000. Incorporators: F. E. Healey, L. K. Cushing, Carl Keith.

The Jersey City Electrical Construction Company, Jersey City, N. J. Capital stock, \$10,000. Incorporators: H. C. Newton and T. M. Simonson of Paterson, N. J., John McCullough of Jersey City.

The Citizens' Electric Railway, Light & Power Company, Mansfield, O., has certified to an increase of capital stock from \$125,000 to \$400,000, also enlargement of purpose and change of termini.

The Peninsular Electric Light & Power Company, Orlando, Fla.—to supply electric light and power, construct electrical machinery and apparatus, and purchase and sell electrical goods of all kinds. Capital stock, \$12,000. Stockholders: B. C. Abernathy, A. Macallum and W. B. Tucker.

The R. Roggatt Manufacturing Company, St. Louis, Mo.—to manufacture electrical appliances. Capital stock, \$25,000.

The Montrose Electric Light & Power Company, Montrose, Col. Capital stock, \$20,000. Incorporators: E. E. Kassler, C. M. Kassler and D. P. Barnes.

The Vinalhaven Electric Light & Power Company, Vinalhaven, Me.—to generate and sell gas and electricity. Capital stock, \$9,900, of which \$300 is paid in. President, George P. Ginn; treasurer, H. L. Hammond, both of Vinalhaven.

The South Bend & Elkhart Railway Company, Elkhart, Ind.—to build an electric railway in Elkhart and Mishawaka as well as over the roads between those cities. Capital stock, \$100,000 of which \$10,000 is subscribed. Incorporators: Arthur Kennedy, J. McEl Smith, Frank Dunahoo, A. L. Brick and DeWitt Dilworth.

The Electrical Wiring Company, Orange, N. J. Capital stock, \$15,000. Incorporators: Kurtz H. Popley and William A. Johnson of West Orange; George W. Huker and Adolph J. Levi of East Orange, N. J., and Gustav A. Hornbeck, of Verona, N. J.

The Cosmopolitan Construction Company, Chicago—to do the construction work of the Cosmopolitan Electric Light Company. Capital stock, \$500,000. Incorporators: Carl Meyer, Charles K. Holden and Alfred S. Austrian.

The Delford Electric Light Company, Hackensack, N. J.—to furnish electric light in the borough of Delford, including Oradell and New Milford. Capital stock, \$10,000. Incorporators: Hugh J. Grant, ex-mayor of New York, Kimball C. Atwood and John B. Lozier.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MARCH 29, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 601,458. Electric Rail-Road. Frederick W. Atkinson, Chicago, Ill. Filed Oct. 4, 1897.
- 601,482. Electric Railway Signaling System. Barney Samuels, St. Joseph, Mo. Filed May 6, 1896.
- 601,212. Car-Fender. George W. Douglas, San Francisco, Cal., assignor to the Market Street Railway Company, same place. Filed Nov. 29, 1897.
- 601,441. Safety-Buffer Car-Fender. John E. Jones, Kingston, Canada, assignor of one-half to Howard S. Folger, same place. Filed March 22, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 601,208. Electric Arc-Lamp. Philip F. Krug, New York City, assignor of one-half to Ernest Unger, same place. Filed Jan. 7, 1897.
- 601,351. Electric Lighter for Gas-Burners. Ladislav V. Lewitzky, Brzeziny, Belgium, assignor to the Compagnie Internationale pour l'Alimentation et l'Extinction Instantanée du Gaz, same place. Filed April 15, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 601,213. System of Electrical Distribution. William L. Hilsa, Brooklyn, N. Y. Filed Oct. 14, 1897.
- 601,216. Electric Switch. Oscar B. Platt, Bridgeport, Conn. Filed Feb. 2, 1897.
- 601,492. Automatic Cut-Out. Henry F. Blackwell, Jr., Brooklyn, N. Y. Filed Aug. 24, 1897.
- 601,581. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Feb. 14, 1898.
- 601,588. Rheostat. Frank E. Pool, Quincy, Ill., assignor to the Smith Hill Elevator Company, same place. Filed Jan. 31, 1898.

ELECTRIC ELEVATORS.

- 601,301. Safety Device for Electric Elevators. John D. Hilder, Yonkers, N. Y., assignor to the Otis Brothers & Company New York City. Filed Oct. 15, 1896.
- 601,581. Elevator Safety Mechanism. John T. Taylor, New York City. Filed Oct. 5, 1897.

MISCELLANEOUS.

- 601,253. Maximum Meter. Adrian H. Hoyt, Penacook, N. H. Filed July 29, 1897.
- 601,246. Fuel-Cut-Out. Ferdinand Schwedtmann, St. Louis, Mo. Filed May 6, 1897.
- 601,318. Regulator for Organs Having Electrical Air-Pumps. Levi K. Fuller, Brattleboro, Vt., assignor to the Estey Organ Company, same place. Filed July 20, 1896.
- 601,347. Means for Supporting Electric Wires. Benjamin Du Bois Smock, Wickatuck, N. J. Filed Feb. 10, 1897.
- 601,347. Electric Furnace for Manufacturing Calcium Carbide. Corydon L. Wilson, Charles Muma, John W. Unge, Henry Schneekloth, Ames P. Brosius and Joseph C. Kuehl, Holstein, Iowa. Filed Feb. 13, 1897. Renewed Feb. 4, 1898.
- 601,344. Cathodic-Electrode Support. Merrill W. Hollingsworth, Philadelphia, Pa., assignor to the M. S. White Dental Manufacturing Company, same place. Filed Nov. 24, 1897.
- 601,412. Wire-Holder. Frank Canfield, Boulder, Col. Filed Oct. 23, 1897.
- 601,434. Clamping-Buckle for Electric Line Wires. Augustus H. Weikman, Palmyra, N. J. Filed Dec. 8, 1897.
- 601,471. Storage Battery. Charles S. Kaufmann, Chicago, Ill., assignor to the American Battery Company, same place. Filed Sept. 4, 1897.

TELEPHONE AND TELEGRAPH.

Some Good Contracts.

The American Electric Telephone Company, Chicago, has secured a very large contract, covering apparatus for 3,000 instruments for the Saginaw Valley Telephone Company, and the company is to put in an underground system at Saginaw, Flint, Bay City and West Bay City. We understand that the apparatus referred to was selected after a very exhaustive test of all apparatus on the market and after the committees had visited all of the large installations using independent apparatus. The company has just expressed to Seattle a 100-number Express style switchboard complete and one hundred telephones, to be used by a company at Dawson City, N. W. T. In this instance the American Electric Telephone Company's apparatus was in competition with the goods manufactured by the American Bell Company and sold through their Dominion agents at Montreal and Vancouver. The apparatus for Dawson City was all packed in very narrow boxes so that it can be placed on sleds and carried through the passes successfully and quickly.

The West Penn Telephone Company has completed arrangements for constructing and maintaining a system of telephone lines between Washington, Pa., Canonburg, McDonald, Burgettstown and other points along the Panhandle Railroad, covering the western and northwestern portion of Washington county. Some of the towns named at present have no telephone communication with other places, and negotiations are pending whereby the company will get communication with Pennsylvania and West Virginia towns through contracts with other private telephone companies. A metallic circuit will be maintained and rates will probably be \$15 per year for private and \$24 per year for business houses.

The Utica, N. Y., Observer says that the farmers in the town of Niles, Cayuga county, are away ahead of their fellowcraft in other parts of the country, for they have a co-operative telephone line in successful operation. Nearly every farmer in the town has a telephone in his house, and when he wants to swap stories with his neighbors all he has to do is to go to the telephone and ring them up. As there is no central station, when he turns the little crank on the 'phone he calls up every man on the circuit. This is a disadvantage when he wishes to carry on a private conversation, but it has not broken any friendships yet, and all consider the telephone a great convenience.

On behalf of the city of Richmond, Va., C. V. Meredith has filed a petition for a writ of certiorari with the Supreme Court of the United States in the case of the city against the Southern Bell Telephone Company. The questions of law involved are of great importance and general interest, because they very materially concern the extent and the limits of the power of municipalities over the construction and operation of telephone lines in their midst.

The Bell Telephone Company has appealed to the State courts from the decision of the Railroad Commission at Raleigh, N. C., reducing the rates of the rental of telephones in North Carolina. The Commission has the privilege of designating the county court to which appeal shall be taken. In the case of the Bell Company's appeal the chairman of the Commission has designated Iredell Superior Court. This court meets in May, when the case comes to trial.

The city council of St. Paul has granted franchises to the Mississippi Valley Telephone Company for a local exchange and to the Minnesota Central Telephone Company for a long-distance system. The mayor has also signed the franchises. Both companies are already in possession of franchises in Minneapolis and within six months expect to be ready for business.

The Mississippi Valley Telephone Company has deposited \$5,000 in cash with the city treasurer at Minneapolis as earnest money for the fulfillment of the ordinance granting it a franchise to carry on a telephone service in that city. Within thirty days from March 26 the company must file its acceptance of the franchise and a big bond or forfeit the money.

The Omaha World-Herald has a despatch from Tecumseh, Neb., stating that the Home Telephone Company to be organized at Tecumseh proposes to make connection with the International Telephone Company. The Nebraska Telephone Company has already begun the erection of its lines in Tecumseh.

The Home Telephone Company of Fort Wayne has been forced to extend its switchboard facilities. The net gain in 'phones in the month of February was 40. The directory of the company, just printed, is the largest so far printed in northern Indiana.

The Standard Telephone Company has, it is said, contracted for a telephone line from Kansas City to Marshall, Mo., and will build several long-distance lines in the State.

Annual Meeting of the American Bell Telephone Co.

The annual meeting of the American Bell Telephone Company was held at Boston on the 29th ult. John R. Hudson was re-elected president, and the directors elected are: Charles W. Amory, Thomas B. Bailey, Francis Blake, Geo. L. Bradley, Alex. Cochrane, T. Jefferson Coolidge, Jr., J. Malcolm Forbes, Henry S. Howe, Chas. Eustis Hubbard, John E. Hudson, Chas. E. Perkins, Thos. Sanders, Moses Williams. The directors' report contains these figures: Instruments in the hands of licensees, under rental, December 20, 1897, 919,111; increase during the year, 146,494; exchanges, January 1, 1898, 1,025, increase 58; branch offices 987, increase 16; miles of wire on poles 327,315; increase 40,683; miles of wire underground 28,684, increase 47,833; miles of wire on buildings 13,776, increase 1,182; miles of wire, submarine, 2,675, decrease 143; total circuits 205,904, increase 31,159; total employees 16,682, increase 2,257; total stations 384,230, increase 58,986. Toll lines—miles of poles 67,791, increase 7,228; miles of wire 324,883, increase 56,017. The report says "the number of exchange stations operated under the licenses of the company is 384,230. This equals within a few thousand the aggregate number of exchange stations in all of Continental Europe. Next to our own country comes the German Empire with 122,361 exchange stations (1896), and next, Great Britain with 83,316. In the United States conversation is now had by subscribers over distances of 1,800 miles, which is twice the length of line anywhere else employed for telephonic use.

"The estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, is 3,099,472, or a total per year of about 998,000,000.

"The number of daily calls per station varies in different exchanges from 17 to 18, the average throughout the United States being 8.1-10, which is the same as the number reported last year.

"The average cost to the subscriber by exchanges varies according to the size of the exchange and character of the service from less than 1 to 9 cents per connection."

The long contest between the Mutual and Iowa telephone companies in Des Moines, Ia., for the patronage of the business houses and residences has now practically closed, with a victory for the Mutual Company. The Iowa Company is yet in the field and is doing business, but it has less than half the business of the Mutual Company.

The People's Telephone line is being built from Blountville, Tenn., to Fall Branch. The construction is being done by farmers and business men along the line, each individual building two miles, thereby securing one paid-up share.

The personal tax assessment of nearly every corporation in Kansas City, Mo., including the telephone, telegraph, electric light, gas and street railway companies, has been raised by the board of equalization.

E. A. Wiles of Randleman, N. C., is said to be contemplating the establishment of a telephone system in Ashboro, N. C.

James Clark is considering the construction of a telephone system at Eddyville, Ky.

New Companies Incorporated.

The Kibble Telephone Company, Kibble, Mich. Capital stock, \$10,000.

The American District Telegraph Company, Dayton, O. Capital stock, \$30,000.

The Worcester Telephone Company, Snow Hill, Md. Capital stock, \$2,500. Incorporators: O. J. Purcell, W. S. Powell, W. F. Johnson, J. P. Moore and others.

The Canadian & Cheyenne Telephone Company, Canadian, Hemphill, County, Tex.—to construct and maintain telephone exchanges and a telephone line from Canadian to Cheyenne, Ok. Capital stock, \$2,500. Incorporators: Robert Moody, George Gerlack and D. J. Young.

The City Telephone Company, New York City—to operate a telephone and telegraph system in and about New York City, New Jersey, Pennsylvania and Southern New England. Capital stock, \$100,000. Directors: Thomas D. Bowen, F. D. Britton, W. F. Chester and Jacob Schwartz, of Manhattan borough; W. J. Scott, of Richmond; J. H. Hingle, of Rutherford, N. J., and W. J. Kelley, of Jersey City.

The Denver News states that a telephone company was incorporated on the 23d ult. to operate in Rio Grande, N. M., general, Saguache, Conejos and Costilla counties, with headquarters at Monte Vista, Col., the object of which is to bring all the towns of the San Luis Valley into "hello" reach. Capital stock, \$10,000. Directors: Adelbert J. White, Henry D. Abrams, Albert M. Isbell and Albert W. Horn.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g. gold, gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Apr. 4:						Hartford Conn.—Apr. 4:					
Albany Ry. Co.....	100	2,000,000	\$1,750,000 1 1/2 % Q., Feb. '98.	140	145 1/2	Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000 8 % S., Jan., '98.	140	..
Troy City Railway Co.....	100	2,000,000	1 % Q., Dec. 10, '97.	70	72	Hartford & West Hartford RR.....	100	1,000,000	247,000 ..	..	..
Traction Co. (Saratoga).....	100	50,000	..	..	..			
Allentown, Pa.—Apr. 4:						Holyoke Mass.—Apr. 4:					
Allentown & Lehigh Val. Trac. Co.....	100	4,000,000	1,500,000 ..	..	15	Holyoke Street Ry. Co.....	100	400,000	400,000 8 % A., Jan., '98.	200	205
Bridgeport, Conn.—Apr. 4:						Hoboken, N. J.—Apr. 4:					
Bridgeport Traction Co.....	100	2,000,000	2,000,000 1 % Aug., '97.	45	60	North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000 8 %, 1892.	70	..
Baltimore, Md.—Apr. 4:						Indianapolis, Ind.—Apr. 4					
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000 5 % S., July 2, '97.	71	72	Citizens' Passenger Ry.....	100	5,000,000	5,000,000 ..	24	25
Baltimore Consolidated Ry. Co....	25	10,000,000	9,177,000 2 % S., Jan. 15, '98.	22 1/2	23	Lancaster, Pa.—Apr. 4:					
Central Ry. Co. of Baltimore City..	50	800,000	800,000 6 % A., Dec., 1897.	80	82 1/2	Pennsylvania Traction Co.....	100	10,000,000	9,900,000 ..	..	..
Boston, Mass.—Apr. 4:						Lancaster & Col. Electric Ry.....	100	87,500	..	..	..
New England Street Ry.....	25	5,000,000	1,081,925 1 % Q., Jan. 15, '97.	..	..	West End Street Railway.....	100	..	..	..	..
North Shore Traction Co.....com.	100	4,000,000	4,000,000 ..	10	13	Louisville, Ky.—Apr. 4:					
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000 6 % S., A. & O.	60	65	Louisville Ry.....	100	4,000,000	3,500,000 1 1/2 % Q., Oct., '97.	81	82
West End Street Ry. Co.....com.	50	10,000,000	9,085,000 1 % S., Oct., '97.	79 1/2	80	Louisville Ry.....	100	2,500,000	2,500,000 2 1/2 % S., Oct. 1, '97.	94	95
West End Street Ry. Co.....8 % pfd.	50	5,400,000	6,400,000 4 % S., Oct. 1, '97.	100	102	Minneapolis, Minn.—Apr. 4:					
Boston Elevated R. R.....	100	10,000,000	..	55 1/2	57	Twin City Rapid Transit.....com.	100	17,000,000	15,010,000 ..	20	25
Brooklyn, N. Y.—Apr. 4:						Twin City Rapid Transit.....7 % pfd.	100	8,000,000	1,714,200 1 1/2 % Q., Jan., '98.	..	100
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,400 2 % Feb. 1, 1898.	180	..	Montreal, Canada.—Apr. 4:					
Brooklyn Exp. Transit Co., tr. certf.	100	20,000,000	20,000,000 ..	39	69 1/2	Montreal Street Ry. Co.....	50	4,000,000	4,000,000 8 % S., M. & N.	257	258
Brooklyn Heights Railroad.....	100	200,000	200,000 ..	..	..	Toronto Street Ry. Co.....	100	6,000,000	6,000,000 1 1/2 % S., J. & J.	95	106 1/2
Brooklyn Ry. Co., guar.....	100	12,000,000	12,000,000 2 1/2 % Q., Jan., '98.	198	199	Memphis, Tenn.—Apr. 4:					
Brooklyn Queens Co. & Sub. RR.....	100	2,000,000	2,000,000 ..	..	..	Memphis Street Railway Co.....	100	500,000	500,000 ..	15	..
Caney Island & Brooklyn RR.....	100	1,000,000	2,000,000 1 1/2 % Oct. 1, '97.	150	180	New Haven, Conn.—Apr. 4:					
Kings County Elevated.....	100	4,750,000	4,750,000 ..	..	..	Fair Haven & Westville RR.....	25	1,500,000	900,000 4 % S., Sept. '97.	60	..
Kings County Traction Co.....	100	4,500,000	4,500,000 1 % July 26, '97.	45	47	New Haven Street Railway Co.....	100	1,250,000	1,000,000 2 1/2 % A., July '96.	60	80
Nassau Electric Railroad.....	50	6,000,000	6,000,000 ..	..	..	New Haven & Centerville.....	100	700,000	800,000 ..	..	..
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000 ..	..	..	Winchester Avenue RR.....	25	1,000,000	600,000 ..	40	42
Brooklyn B. & W. R. Railroad.....	100	1,000,000	1,000,000 ..	74	80	New Orleans, La.—Apr. 4:					
Buffalo, N. Y.—Apr. 4:						Canal & Claiborne RR. Co.....	40	240,000	240,000 4 % S., Jan., '98.	140	160
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000 ..	58	60	New Orleans & Carrollton RR.....	100	1,200,000	1,200,000 1 1/2 % Q., Jan., '98.	123 1/2	124
Buffalo Railway Co.....	100	6,000,000	5,870,500 1 % Q., Dec., '97.	78	80	New Orleans Traction Co.....com.	100	5,000,000	5,000,000 ..	2	5
Columbus O.—Apr. 4:						New Orleans Traction Co.....pfd.	100	2,500,000	2,500,000 ..	18	15
Columbus Street Railroad.....	100	8,000,000	8,000,000 1 % Q., Feb., '98.	47	46	Crescent City RR.....	100	2,000,000	2,000,000 8 % S., Jan., '98.	..	30
Columbus Central Street Railroad..	100	1,500,000	1,500,000 ..	..	..	New Or. City & Lake RR.....	100	2,000,000	2,000,000 4 % S., Jan., '98.	81	88
Charleston, S. C.—Apr. 4:						St. Charles Street Railway.....	50	500,000	185,000 1 1/2 % Q., June, '94.	16	17
Charleston City Ry. Co.....	50	100,000	100,000 8 % S., Jan., '97.	..	..	New York, Apr. 4:					
Enterprise City RR. Co.....	25	1,000,000	250,000 ..	..	..	Central Crotonwater RR.....	100	600,000	600,000 2 1/2 % Q., July, '97.	195	..
Chicago, Ill.—Apr. 4:						Christopher & 10th Sts. RR. guar.	100	650,000	650,000 2 % Q., Jan., '98.	165	165
Chicago City Ry. Co.....	100	12,000,000	12,000,000 8 % Q., Dec. 31, '97.	230	235	Dry Dock, E. B. & W. & Battery RR.	100	1,200,000	1,200,000 1 1/2 % Q., Feb., '98.	180	180
Chicago & South Side R. T. RR.....	100	10,828,800	10,828,800 ..	10 1/2	10 1/2	Manhattan Street Ry. Co.....	100	80,000,000	80,000,000 1 1/2 % Q., Jan., '98.	18 1/2	189 1/2
Lake Street Elevated RR.....	100	10,000,000	10,000,000 ..	..	..	Bleecker St. & Fulton Ry. Co. guar.	100	900,000	900,000 1 1/2 % A., July, '97.	30	38
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000 ..	..	..	Broadway & Seventh Ave. Ry. guar.	100	2,100,000	2,100,000 2 1/2 % Q., Oct., '97.	208	..
Met. West Side El. const. stk.....	100	15,000,000	2,500,000 ..	..	..	Gen. Park N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2 1/2 % Q., Jan., '98.	178	180
North Chicago Street RR.....	100	10,000,000	6,800,000 8 % Q., Jan., '98.	216	220	Eleventh Avenue RR.....	100	1,000,000	1,000,000 ..	810	825
North Chicago City RR.....	100	500,000	249,900 ..	..	..	42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2 % Q., Feb., '98.	320	350
South Chicago City RR.....	100	2,000,000	1,603,300 ..	..	..	Ninth Avenue RR.....	100	800,000	800,000 ..	180	190
West Chicago St. RR. Co.....	100	20,000,000	18,189,000 1 1/2 % Q., Feb., '98.	90	91	Sixth Avenue RR.....	100	2,000,000	2,000,000 ..	195	..
Chicago West Div. Ry.....	100	1,250,000	624,900 35 % ..	..	..	Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4 1/2 % Q., Feb., '98.	800	825
Chicago Passenger Ry.....	100	2,000,000	2,000,000 5 % S.	..	..	Third Avenue RR.....	100	2,500,000	1,862,000 2 % Q., Jan., '98.	160	165
Cincinnati, Ohio.—Apr. 4:						42d St. Manhattan & St. Nich. Av.	100	10,000,000	10,000,000 2 % Q., Feb., '98.	187	190
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000 ..	..	20	Union (Hook & Berry) Ry.....	100	2,000,000	2,000,000 ..	58	61
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000 ..	..	75	Newark N. J.—Apr. 4:					
Cincinnati Newport & Cov. St. Ry.	100	4,000,000	8,500,000 ..	..	25	Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000 ..	42	44
Cincinnati Street Ry. Co.....	100	18,000,000	14,000,000 1 1/2 % Q., Jan., '98.	112 1/2	118	Newark Passenger Ry.....	100	6,000,000	6,000,000 ..	..	..
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1 1/2 % Q., Jan., '98.	..	..	Rapid Transit Street Ry.....	100	504,000	504,000 11 1/2 % A.	180	190
Cleveland, Ohio.—Apr. 4:						Pittsburg, Pa.—Apr. 4:					
Arron, Red. & Cleve. Elec. Ry.....	100	1,000,000	1,000,000 1/2 % Jan., '98.	89	40	Allegheny Traction Co.....	50	500,000	500,000 ..	..	45
Cleveland City Ry.....	100	8,000,000	7,600,000 1/2 % Q., Oct., '97.	62	63	Consolidated Traction Co.....com.	50	15,000,000	15,000,000 2 % Jan., '98.	18 1/2	..
Cleveland Electric Ry.....	100	12,000,000	12,000,000 1/2 % Q., Oct., '97.	59	59 1/2	Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000 8 % May, '97.	46	46 1/2
Detroit, Mich.—Apr. 4:						Central Traction Co.....	50	1,800,000	1,800,000 ..	..	..
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000 ..	100 1/2	..	Citizens' Traction Co.....	50	8,000,000	13,000,000 6 % A.	..	..
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000 5 % July, '96.	175	..	Duquesne Traction Co.....	50	8,000,000	13,000,000 6 % A.	..	..
Rapid Railway Co.....	100	250,000	250,000 ..	..	100	Pittsburg Traction Co.....	50	2,500,000	1,900,000 8 % A.	..	..
Detroit Electric Railway.....	100	1,000,000	1,000,000 ..	..	..	Federal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000 2 1/2 % Aug., '96.	..	..
Windsor & Detroit River Ry.....	100	250,000	200,000 ..	100	110	Pgh., Allegheny & Man. Trac. Co....	50	8,000,000	1,862,000 2 % Q., Jan., '98.	..	..
Dayton O.—Apr. 4:						Pittsburg & Birmingham Trac. Ry.	25	8,000,000	12,984,589 2 % Aug., '96.	..	..
City Railway Co.....com.	100	1,500,000	1,470,600 1 1/2 % Q., Jan. 1, '98.	100	102	Pittsburg & West End Ry.....	50	1,500,000	8,000,000 1 1/2 % Jan., '96.	18 1/2	19
City Railway Co.....pfd.	100	500,000	600,000 1 1/2 % Q., Jan. 1, '98.	140	145	Second Avenue Traction Co.....com.	50	4,000,000	1,500,000 1/2 % A., June 30, '97.	..	..
People's Street Railway.....	100	1,100,000	..	100	..	Suburban Rapid Transit Co.....	50	800,000	200,000 ..	..	..

*Unlisted. † Ex div.
 A Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h 90 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$50,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 10 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$25,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crotonwater Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts' Trac. Co.
 p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 8 % on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4 % on capital stock after October.
 s Leased to Consolidated Traction Company for 1 % on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.		Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.		Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	
			Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—Apr. 4:														
Union Street Railway Co.....		100	\$850,000	\$850,000	2 %	Feb. '98.	...	158	Boston, Mass.—Apr. 4:					
Northampton, Mass.—Apr. 4:														
Northampton Street Ry.		100	800,000	225,000	4 % A., Jan., '98.	165	175	American Bell Telephone Co.....						
Omaha, Neb.—Mar. 28:								Erie Telegraph & Telephone Co....						
Omaha Street Ry.....		100	5,000,000	5,000,000	.....	25	..	New England Telephone Co.....					
Paterson, N. J.—Apr. 4.								New York.—Apr. 4:						
Paterson Ry. Co.....		100	1,250,000	1,250,000	.....	85	86	American Telegraph & Cable Co....					
Providence, R. I.—Apr. 4.								*Central & South Am. Tel. Co.....						
United Traction & Electric Co		100	8,000,000	8,000,000	3 %	Jan. '98.	55	60	*Commercial Cable Co.....					
Philadelphia.—Apr. 4:								Franklin Tel. Co.....						
Fairmount Park Trans. Co. \$20 pd.		50	2,000,000	1,770,000	2 %	Dec. '97.	14%	..	Erie Telegraph & Telephone Co.....					
Hestonville, Man. & Fairmount.....		50	1,966,100	1,966,100	2 %	July 15, '97.	42	45	*Gold & Stock Tel. Co. guar. 6%					
Hestonville, Man. & Fairmount.....		50	588,900	588,900	3 %	Jan. 10, '98.	61	65	*International Ocean Tel. Co. guar. 6%					
Fairmount Pk. & Had. Pass. Ry.....		50	800,000	800,000	3 %	Feb. 1, '98.	68	66	Mexican Telephone Co.....					
Union Traction Co.....		50	30,000,000	23,930,450	.....	15%	15%	*New York & New Jersey Tel. Co....					
Electric Traction Co.....		50	...	8,297,920	.....	71%	71%	*Pacific & Atlantic Tel. guar. 4%					
Citizens' Passenger Ry.....		50	500,000	192,500	\$8 share Q.	307	...	*Postal Telegraph Cable Co.....						
Frankford & Southwark Pass. R.		50	...	11,875,000	\$14 share A.—Apr. 97	872	...	*South & Atlantic Tel. Co. guar. 5%						
Lehigh Avenue Ry. Co.....		50	1,000,000	...	.....	47	...	*Commercial Union Telegraph Co....					
Lombard & South Street Ry.....		25	...	1,000,000	A. & O.	89	90%	Western Union Telegraph Co.....						
Second & Third Streets Ry.....		50	1,000,000	771,076	\$9 share A., Mar. 97	265	...	*Div. guar. by Postal Tel. Co.						
People's Traction Co.....		50	10,000,000	16,000,000	8 %	A., April, '97.	...	Miscellaneous.—Apr. 4:						
Germantown Passenger Ry.....		50	1,500,000	572,800	\$5.25 share—1898.	184	185	American Dist. Tel. (Phila.).....						
Green & Coates Passenger Ry.....		50	500,000	150,000	3 %	Jan., 1898.	182	...	Bell Teleph. Co. (of Canada).....					
People's Passenger Ry.....		25	1,500,000	740,000	.....	...	...	Cheapeake & Potomac Tel. Co....					
People's Passenger Ry..... pfd.		25	750,000	277,402	.....	...	...	Chicago Telephone Co.....					
Philadelphia Traction Co.....		50	30,000,000	120,000,000	4 %	S.—Oct. 1, '97.	79%	79%	Central Dist. Prtg. & Tel. Co. (Phg.)					
Catherine & Bainbridge St.....		50	...	400,000	6 %	A.—Mar. '97.	Empire & Bay States Telegraph Co.					
Continental Pass. Ry. guar.		50	1,000,000	580,000	\$6 share—July, '97.	185	140	...	Hudson River Telephone Co.....					
Empire Passenger Ry. Co.....		50	600,000	600,000	.....	...	...	*Northwestern Telegraph Co. guar.					
Philadelphia City Pass. Ry.....		50	1,000,000	1475,000	\$7.50 share July '97	176%	180	...	Providence (R. I.) Teleph. Co.....					
Philadelphia & Gray's Ry. RR.		50	1,000,000	298,650	\$8.50 share July '97	86	...	Southern New Eng. Teleph. Co.....						
Ridge Avenue Passenger Ry.....		50	750,000	420,000	\$12 share, July '97.	...	800	ELECTRIC LIGHT AND ELECTRICAL MFG. COS.						
Philadelphia & Darby Ry. guar.		50	...	200,000	\$2 share July, '97.	...	...	Boston, Mass.—Apr. 4:					
17th & 19th Sts. Pass. Ry. guar.		50	...	250,000	1% S., July, '97.	157%	...	Fort Wayne Electric Co.....						
Thirteenth & 15th Sts. Pass. Ry.		50	1,000,000	835,000	\$11 sh. A., July, '97	275	...	Pt. Wayne Elec. Co. T. Sec. Series A.						
Union Passenger Ry. Co.....		50	1,500,000	900,000	\$9.50 shre, July '97	227	228	General Electric Co.....						
West Philadelphia Pass. Ry.....		50	750,000	750,000	\$10 share, July '97	225	235	General Electric Co..... pfd.						
Rochester, N. Y.—Apr. 4:								T. H. Elec. Co. T. Secur. Series D.						
Rochester Railway Co.....		100	5,000,000	5,000,000	.....	15	20	Westinghouse Elec. & Mfg. Co. com.					
Reading, Pa.—Apr. 4:								Westinghouse El. & Mfg. Co. pfd.						
Reading Traction Co.....		...	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	...	Westinghouse El. & Mfg. Co. assent.						
City Passenger Ry.....		50	850,000	850,000	Jan., '98.	112	...	New York.—Apr. 4:						
East Reading Electric Ry.....		50	1,000,000	1,000,000	Jan., '98.	64	...	Edison Elec. Ill'g Co., New York...						
St. Louis Mo.—Apr. 4:								*Edison Elec. Ill'g Co., Brooklyn...						
Fourth Street & Arsenal Ry.....		50	800,000	150,000	.....	...	...	Edison Ore. Milling Co.....					
Jefferson Avenue Ry. Co.....		50	400,000	400,000	2 %	Dec., 1898.	...	Edison Electric Storage Co.....						
Lindell Ry.....		100	2,500,000	2,400,000	1% Jan. '98.	120	122	General Electric Co.....						
National Railway Co.....		...	2,500,000	2,479,000	1% Jan., '98.	...	...	General Electric Co..... pfd.					
Cass Avenue & Fair Grounds.....		...	2,500,000	2,500,000	...	...	...	Interior Conduit & Insulation Co...					
Citizens' RR.....		100	2,000,000	1,500,000	4 %	Oct., '98.	90	110	United Elec. Lt. & Pow. Co.....					
St. Louis RR.....		100	2,000,000	2,000,000	2% Jan., '98.	95	105	Pittsburg, Pa.—Apr. 4:						
Missouri RR.....		50	2,400,000	2,300,000	1% Jan., '98.	170	172%	Allegheny County Light Co.....						
People's RR. Co.....		50	1,000,000	800,000	50c., Dec., '89.	...	...	East End Electric Light Co.....					
Southern Electric Ry.....		50	500,000	500,000	...	50	52%	Philadelphia, Pa.—Apr. 4:						
Southern Electric Ry..... 6 % pref.		100	1,000,000	1,000,000	1% Jan., '98.	100	102%	Edison Electric Light Co.....						
St. Louis & Suburban Ry.....		100	2,500,000	2,500,000	...	53	55	*Electric Storage Battery Co. com.						
Union Depot RR.....		100	4,000,000	4,000,000	8 % A., July, '98.	...	175	*Electric Storage Battery Co. pfd.						
San Francisco, Cal.—Mar.								*Penna. Ht., Lt. & Pow. Co. com.						
California St. Cable RR.....		100	1,000,000	600,000	50c. monthly.	...	110	*Penna. Ht., Lt. & Pow. Co. pfd.						
Geary Street Park & Ocean RR.....		100	1,000,000	875,000	\$2.50 share, '96.	40	50	Northern Elec. Light & Power Co...						
Market Street Ry.....		100	18,750,000	18,750,000	Q., 60c. per share.	52%	53	Southern Elec. Light & Power Co...						
Presidio & Ferries RR.....		100	1,000,000	550,000	.....	...	8%	Miscellaneous.—Apr. 4:					
Scranton, Pa.—Apr. 4:								Brush Electric Co.....						
Scranton Railway Co.....		50	6,000,000	2,500,000	.....	10	12	Bridgeport (Conn.) Elec. Lt. Co....					
Scranton & Carbondale Trac. Co...		100	500,000	500,000	.....	...	18	Edison Ill'g Co. (St. Louis).....					
Scranton & Pittston Traction Co...		100	1,050,000	1,050,000	.....	...	...	Eddy Electric Mfg. Co.....					
Springfield Ill.—Apr. 4:								Hartford (Conn.) Elec. Light Co...						
Springfield Consolidated Ry.....		100	750,000	750,000	.....	...	11	Hartford (Conn.) Lt. & Power Co...					
Springfield O.—Apr. 4:								New Haven (Conn.) Elec. Lt. Co....						
Springfield Street Ry.....		100	1,000,000	1,000,000	.....	...	2	Narragansett (Prov., R. I.) Elec. Co.					
Springfield, Mass.—Apr. 4:								Rhode Island Elec. Protec. Co.....						
Springfield Street Ry.....		100	1,200,000	1,166,700	8 % A.	205	210	Royal Elec. Co. (Montreal).....						
Toronto Canada.—Apr. 4:								Toronto (Canada) Elec. Light Co...						
Toronto Ry. Co.....		100	6,000,000	6,000,000	1% S.	95	95%	Thomson-Houston Welding Co.....						
Montreal Street Railway Co.....		100	4,000,000	4,000,000	4 % S.	257	258	Woonsocket (R. I.) Electric Co.....						
Washington, D. C.—Apr. 4:								ALLIED INDUSTRIES.						
Belt Ry. Co.....		50	500,000	500,000	.....	40	...	Boston Mass.—Apr. 4:					
Capital Traction Co.....		100	12,000,000	12,000,000	65c. per sh. Oct. 97.	72%	72%	American Electric Heating Co.....						
Columbia Ry. Co.....		50	400,000	400,000	6 % A.	70	75	Street Ry. & Ill'g Properties... pfd						
Eckington & Soldiers' Home Ry...		50	707,000	652,000	.....	13	...	United Electric Securities Co. pfd.					
Georgetown & Tenallytown Ry.....		50	200,000	200,000	.....	...	...	New York.—Apr. 4:					
Metropolitan RR. Co.....		50	1,000,000	438,900	2% Q.	116%	117	Consolidated Electric Storage Co...						
Worcester, Mass.—Apr. 4:								Edison European.....						
*Worcester Traction Co..... com.		100	8,000,000	8,000,000	.....	16%	18	Safety Car Heating & Lighting Co...					
*Worcester Traction Co..... 6 % pfd.		100	2,000,000	2,000,000	8 % S., Feb., '98.	98	95	Worthington Pump Co.....						
Worcester & Suburban Street Ry...		100	550,000	542,500	4% S., 1897.	85	...	Worthington Pump Co..... pfd						
Wilkesbarre, Pa.—Apr. 4:								Philadelphia, Pa.—Apr. 4:						
Wilkesbarre & Wyoming Val. Trac.		100	5,000,000	5,000,000	1% Jan., '97.	24	29	Acetylene L. H. & P. Co.....						

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. (Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 c Practically all shares owned by Union Traction Company.
 d Leased to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 e Leased to Electric Traction Company.
 f Controlled by Frankford & Southwark Passenger Railway.
 g Leased to People's Passenger Railway at \$5 per share.
 h Majority of stock owned by People's Traction Company.
 i Leased to Union Traction Company.
 j Lease transferred to Union Traction Company.
 k Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Apr. 4, 1898.						
The Albany Ry.....1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co.....Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*111	.....
The Albany Ry. Co.....Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....
Waterfront Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*117½	.....
Waterfront Turnpike & RR...2d mtg. 6s	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co.....1st 5s	.....	.....	.....	.....	*105¼	106½
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.						
Date of Quotation—Apr. 4, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Ext'n. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & N.	102½	103
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114	115
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	19 0	J. & J.	101½	.....
Bal. Trac. Co. Convertible 5s.	800,000	.....	19 6	N. & M.	103½	.....
Baltimore Traction Co. 1st mtg. 6s	96,000	117,000	1912	J. & J.	110	.....
Central Pass. Ry. Co. Cons. mtg. 5s.	601,000	580,000	1932	M. & N.	113	116
Central Pass. Ry. Co. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113¾	114¼
City & Suburban Ry. 1st mtg. g. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....
Lake Roland Elev. 1st mtg. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119½
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	.....	.....	.....	.....	.....	.....

The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
\$151,000 in escrow to retire 1st mtg. bds.

Boston, Mass.						
Date of Quotation—Apr. 4, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	8,702,000	1924	J. & D.	161¼	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	.....
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						

Charleston S. C.						
Date of Quotation—Apr. 4, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.						

Chicago Ill.						
Date of Quotation—Apr. 4, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¾	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103¾	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 2d mtg. g. 5s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	.....	.....
Metrop. W. Side Elev. Ry. 1st mtg. 5s.	15,000,000	15,000,000	1942	F. & A.	46	48
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	103½	.....
North Chicago St. RR. Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	.....	105
North Chicago City Ry. Consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103	104
West Chicago St. RR. 1st mtg. 6s.	4,100,000	3,969,000	1928	M. & N.	103	104
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100	100½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	90½	91¼
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co. lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chi. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.						

Cincinnati, O.						
Date of Quotation—Apr. 4, 1898.						
Cin. New & Cov. St. Ry. 1st Con. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 2d mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk In. Cons. mtg. 5s.	531,770	531,000	1906	M. & S.	.....	108½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	.....	119
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	129½	.....
Assumed by the Cin. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.						

Cleveland, O.						
Date of Quotation—Apr. 4, 1898.						
aBrooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	105	106
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	100½	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	101	103
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	105
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	106½	107½
aEast Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	106½	107½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	90	95
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	100	102
St. Ry. Co. Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	107½	.....
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.						

Detroit, Mich.						
Date of Quotation—Apr. 4, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,835,000	1905	A. & O.	.....	99
Ft. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	1902	A. & O.	.....	99½
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	98½	99½
\$1,150,000 in escrow to retire bonds of Del. City Ry. and Grand River St. Ry.						

New Haven Conn.						
Date of Quotation—Apr. 4, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	104	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	102	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	104	.....
Winchester Avenue RR. Deben. g. 6s.	100,000	94,000	1909	M. & S.	102	.....

New Orleans La.						
Date of Quotation—Mar. 28, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	100	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	8,000,000	1943	J. & J.	72½	.....
New Orleans City RR. 1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	110
N. Ori.'s City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	96	97½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	108	.....
Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	91½	99
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	103	.....
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$90,000 outstanding.						

New York.						
Date of Quotation—Apr. 4, 1898.						
Atlantic Ave. (Brooklyn)..... Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	....
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	108
Atlantic Av. (Brooklyn) Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	100	108
Broadway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave..... 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Broadway & 7th Ave..... 2d mtg. 5s.	500,000	500,000	1914	J. & J.	106	108
Broadway Surface..... 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	112	114
Broadway Surface..... 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	103½	107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	115
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1899	J. & J.	114	116
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	83	85
Brooklyn Heights RR..... 1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	.....
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	104	106
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Brooklyn Rapid Transit..... gold 5s.	7,000,000	5,181,000	1945	.....	92½	94
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	104	107
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	113	115
Central Crosstown RR..... 1st mtg. 5s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	102	105
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y R. scrip 5½	1,100,000	1,100,000	1914	F. & A.	100	103
Eighth Av. RR. Co..... Cert. indeb. 6½	1,000,000	1,000,000	1914	F. & A.	100	103
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	114	116
42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	91
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	115	117
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	109¾	.....
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	100	105
Stelway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	102	107
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123	123½
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	105	108
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	104½	106
Westchester Electric RR..... 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
* \$1,035,000 in escrow to retire gen. mtg. bonds						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Apr. 4, 1898						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	108
Lindell Ry. Co. 1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	104½	107½
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co. 1st mtg. 6s.	400,000	300,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co. 1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. 1st mtg. 6s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry. Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry. 1st mtg. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	112½	118½
Controlled by St. Louis RR. Co.						
Controlled by Union Depot RR. Co.						
Controlled by Lindell RR. Co.						
\$200,000 in escrow to retire 1st & 2d mtg.						
\$500,000 in escrow.						
\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Mar., 1898.						
California St. Cable RR. 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferris & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co. 1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
Omnibus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR. 1st mtg. 6s.	850,000	850,000	1912	J. & J.	105½	.....
Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Apr. 4, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Apr. 4, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	100	103
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,548,000	1931	F. & A.	110	112
Citizens' St. R. (Ind'polis) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
Croastown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,866,000	1932	M. & N.	108	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	18,965,000	1933	J. & D.	101½	102
Croastown St. Ry. (Colu's O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	110½	111
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 5s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry. Cons. mtg. g. 5s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	101	102
St. Paul City Ry. Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 5s.	1,000,000	1,000,000	1900	.....	85	92½
\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
\$300,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
\$87,000 in treasury.						
\$960,000 res'ed to redeem prior liens.						
\$520,000 in escrow.						
*With interest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Apr. 4, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	Quar.	154	.....	.....
General Electric Co., gold coup. deb. 5s..	10,000,000	8,750,000	1922	.....	100 1/2	.....
Pittsburg, Pa.						
Date of Quotation—Apr. 4, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	106	.....
Allegheny City Electric Light..... 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Apr. 4, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,160,000	1993	.....	114 1/2	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia)....	2,000,000	.....	.....	.....	108	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	5,000,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Apr. 4, 1898.						
American Bell Telephone..... 7s.	.....	.....	1898	F. & A.	100 1/2	104
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	108 1/2	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	.....	.....	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Apr. 4, 1898.						
American Electric Heating..... 6s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 7s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 7s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 6s.	75,000	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11 1/2c.; Lake, 11.90@12c.; casting, 11 1/2c.

The Pennsylvania Heat, Light & Power Company has declared the regular semi-annual dividend of \$1.55 on the preferred and 50 cents on the common stock.

Among the American securities listed recently by the London Stock Exchange was \$603,000 thirty-year consolidated 5s of the Milwaukee Electric Railway & Light Company.

The New England Motor Company has been incorporated under the laws of Massachusetts and will establish works at Lowell, Mass., for the construction of electric motors. The capital stock is \$10,000.

The Philadelphia "Times" remarks: "The failure of the Acetylene Light, Heat & Power Company recalls the remarkable rush to subscribe for the stock three years ago. The amount offered was over-subscribed several times."

The Boston "News Bureau" states that the acetylene plant at Niagara Falls, costing \$150,000, has been taken under foreclosure of mortgage for \$83,000 by the Electro Gas Company, from which corporation the Acetylene Company purchased its patent rights.

An attachment against the Imperial Electric Company, New York, is in the hands of the sheriff. The product of the company was electric motors and lamps; for a year it has been working for the Puritan Electric Company which was recently closed out by the sheriff.

Judge Simonton of the United States Court entered a decree at Lynchburg, Va., on the 30th ult., confirming the sale of the Lynchburg Electric Company's plant, recently made to Walter S. Johnson and R. A. C. Smith, of New York, representing a majority of the bondholders.

Judge Cox has appointed Henry A. Griswold and Benjamin S. Minor receivers of the Anacostia & Potomac River Railroad Company, Washington, D. C. The court directs that the receivers shall give bond in the penalty of \$50,000 conditioned for the faithful discharge of their duties.

Justice Dickey in the Supreme Court of Brooklyn has granted Receiver Frothingham of the Kings County Elevated Railroad Company permission to issue \$400,000 receiver's certificates to be used in completing the connection between the elevated structure and the Brooklyn Bridge.

A deed of trust has been filed in the office of the Recorder of Deeds at Washington, D. C., by the Capital Traction Company to Thomas Hyde, James M. Johnson and Charles A. James, to secure the payment of \$1,000,000, represented by 100 bonds of the denomination of \$10,000, upon its roads and franchises, to pay for improvements recently made.

The annual return of the Thomson Electric Welding Company, Boston, is as follows: Assets—Machinery, \$6,234; cash, debts receivable, \$50,120; manufactures, merchandise, etc., \$8,403; patent rights, \$104,983; miscellaneous, \$61,564; total, \$231,304. Liabilities—Capital stock, \$192,040; debts, \$341; balance, profit and loss, \$38,923; total, \$231,304.

One of the largest mortgages ever filed on property in Montgomery, Ala., has been filed in the probate office in that city in favor of a Baltimore firm by the Montgomery Light Company. It is for \$750,000 and it is to secure the first mortgage bonds that are to be issued by the company for the improvement and enlargement of its gas and electric light plants.

A deed of trust has been filed at Parkersburg, W. Va., given by the Parkersburg Gas, Electric & Street Railway Company to the Mercantile Trust & Deposit Company of Baltimore, Md., upon all the Parkersburg company's property, franchises, etc., to secure the issue of \$150,000 five per cent. forty year bonds. The proceeds of these bonds are to be used in the construction of an electric railway.

The financial statement of the United Electric Securities Company, Boston, as of March 1, 1898, just filed with the Commissioner of Corporations, is as follows: Assets—Investments, \$908,204; underlying first mortgage bonds, \$4,196,600; accrued interest, \$74,169; cash, \$141,734; total, \$5,320,707. Liabilities—Capital stock, \$1,500,000; collateral trust 5 per cent. bonds, \$3,620,000; surplus, \$200,707; total, \$5,320,707.

Receiver Uhlmann of the Brooklyn Elevated Railroad has been authorized by Justice Dickey to enter into a contract with the Long Island Railroad providing for the joint construction of a connecting line at East New York and the running of through trains from the Brooklyn Bridge via the Broadway line of the Elevated Company to Rockaway Park and other stations on the Rockaway branch of the Long Island road.

The Baltimore and New York capitalists who have purchased the electric street railways and the electric light plants of Knoxville, Tenn., will form a new company with a capital stock of \$750,000. The properties in the consolidation are the Knoxville Street Railway, Citizens' Railway and the West End Railway, the Knoxville Electric Light & Power Company and the Mutual Light & Power Company. It is proposed to issue bonds for \$850,000, paying interest at the rate of 5 per cent. per annum, to cover the bonds on the individual properties and to provide for extension, new equipments, etc. These bonds are to be secured by a first mortgage. The Baltimore Trust & Guarantee Company is the trustee. Frank S. Hambleton of the banking firm of Hambleton & Co., Baltimore, will, it is said, be the president of the new company, with C. C. Howell, manager of the Knoxville Street Railway Company, as vice-president and general manager.

The General Electric Company has filed a statement of its condition January 1 (the company's fiscal year ends January 31) with the Commissioner of Corporations, Boston. The statement, to which we append that of 1896 for comparison, is as follows:

	1897.	1896.
Assets:		
Real estate.....	\$659,113	\$444,487
Cash and debts receivable.....	6,560,727	10,176,755
Goods on hand and in process.....	8,896,872	8,898,757
Patent rights.....	8,000,000	8,000,000
Debentures in treasury.....	2,000,000	512,182
Miscellaneous securities.....	10,774,398	11,767,650
Balance (deficit).....	11,804,111	12,697,685
Total.....	\$48,199,228	\$47,607,428
Liabilities:		
Capital stock.....	\$34,712,000	\$34,712,000
Debts and reserve.....	8,487,228	12,895,428
Total.....	\$43,199,228	\$47,607,428

The lease of the Consolidated Traction Company of New Jersey to the North Jersey Street Railway Company provides for a guaranteed dividend of 2 per cent. for the first year and an annual increase to 4 per cent. in eight years and remaining at that afterward. The new board of the Consolidated, just elected, consists of Peter A. B. Widener, William L. Elkins, Thomas Dolan, Almeric H. Paget, John D. Grimmins, Thomas F. Ryan, Edward F. C. Young, Jeremiah O'Rourke, Clement A. Griscom, George F. Perkins, A. J. Cassatt, David Young, Abram Q. Garretson, Elisha B. Gaddis and J. B. Shanley. The officers re-elected are: E. F. C. Young, president; E. B. Gaddis, first vice-president; David Young, second vice-president; E. N. Hill, treasurer; Thomas J. George, secretary. The North Jersey Company will control all trolley lines in northern New Jersey except the North Hudson County. The officers of the North Jersey are: President, J. K. Corbiere; vice-president, H. M. Doremus; secretary and treasurer, Wilbur S. Johnson.

ESTABLISHED 1888
PUBLISHED EVERY WEDNESDAY
BY THE
ELECTRICITY NEWSPAPER COMPANY
136 LIBERTY ST., NEW YORK
LONG DISTANCE TELEPHONE, 4081 CORTLANDT.
Subscription Rates:
United States, \$2.50
In Clubs of Five or More, 2.00
Foreign Countries, 4.50
Single Copies, 10 cents
Advertising Rates:
As ELECTRICITY reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.
Entered at the New York Post Office as second-class mail matter.
THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.
CONTENTS:
Alphabetical List of Advertisements, vi
Classified List of Advertisements, viii
Editorial Notes, 209-210
Courts End the Trust Monopoly.
The Trans-Mississippi and International Exposition.
Locating Submarine Mines by Means of the Telautograph.
The Electrical Exhibition.
Under the Searchlight, 210
"Progressive Euclyre."
"Corporations for the Consumption of Stockholders."
An Easter Souvenir, 211
The Latest Trolley Litigation, 211
Revised Partial List of Exhibitors at the Second Electrical and Kindred Industries Exhibition, 212
Costly Litigation, 212
Electrical Engineering Schools United, 212
Insulation and Conduction. By Reginald A. Fessenden. (Concluded), 213
The Regulation and Protection of the Electric Motor. By Harry H. Cutler, 215
Legal Notes, 218
The News, 218
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.
Recent Company Elections, 219
Commercial Paragraphs, 219
Incorporations, 220
Electrical Patent Record, 220
Telephone and Telegraph, 220
Electrical Securities—Stocks, Bonds, Etc., 221
Notes for Investors, 224

ELECTRICITY.

Vol. XIV. NEW YORK, APRIL 13, 1898. No. 14.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.
Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:
As ELECTRICITY reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.
Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	vi
Classified List of Advertisements,	viii
Editorial Notes,	209-210
Courts End the Trust Monopoly.	
The Trans-Mississippi and International Exposition.	
Locating Submarine Mines by Means of the Telautograph.	
The Electrical Exhibition.	
Under the Searchlight,	210
"Progressive Euclyre."	
"Corporations for the Consumption of Stockholders."	
An Easter Souvenir,	211
The Latest Trolley Litigation,	211
Revised Partial List of Exhibitors at the Second Electrical and Kindred Industries Exhibition,	212
Costly Litigation,	212
Electrical Engineering Schools United,	212
Insulation and Conduction. By Reginald A. Fessenden. (Concluded),	213
The Regulation and Protection of the Electric Motor. By Harry H. Cutler,	215
Legal Notes,	218
The News,	218
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Recent Company Elections,	219
Commercial Paragraphs,	219
Incorporations,	220
Electrical Patent Record,	220
Telephone and Telegraph,	220
Electrical Securities—Stocks, Bonds, Etc.,	221
Notes for Investors,	224

EDITORIAL NOTES.

Courts End the Trust Monopoly.
The Van Depoele trolley patent No. 495,443, controlled by the General Electric Company, has been declared invalid by Judges Wallace and Shipman of the United States Circuit Court of Appeals. This patent and a prior one granted to Van Depoele in 1890 have been in constant litigation almost from the day of their issue. In an editorial which appeared in ELECTRICITY, July 28, 1897, we gave in detail a history of these patents. As the principal one is now declared void it might be in place to again relate the various steps which led up to this recent and final decision. A suit was brought in May of 1893 by the Thomson-Houston Company, a branch of the General Electric Company, against the Winchester Avenue Railway Company in Connecticut and the Westinghouse Company for the infringement of the Van Depoele patents No. 495,443 and No. 495,383. The claim made by the Thomson-Houston Company was that the former covered broadly the combination of a car, a track, an overhead conductor, a contact device supported at the end of a long swinging arm bearing against the under side of the conductor, and a tension device for pressing the contact up against the wire, and that the 495,383 patent covered a turntable device in which the trolley arm was mounted. After a protracted and expensive contest between the above mentioned companies before Judge Townsend of Connecticut in December, 1895, the 495,443 patent was sustained, but the patent for the turntable device was declared invalid.

This defeat of the Westinghouse Company was one of, if not the principal reason for the combination on patents of the General Electric and Westinghouse companies which immediately followed. The patent, backed as it was by the opinion of Judge Townsend, at once became the main instrument in maintaining an oppressive monopoly against all outsiders. Injunctions were obtained against manufacturers of railway apparatus and against railroad companies all over the country, and among others the Walker Company of Cleveland, O., were enjoined. In one case a company settled with the complainants by paying \$100 a car, or \$20,000 for the right to continue to use the equipments on 200 cars.

The Walker Company of Cleveland however refused to give up the fight, and appeared as a bidder for a share of the trolley business of the country. Consequently, in 1897, suit was brought by the General Electric-Westinghouse combination against the Hoosick Railway Company, equipped with Walker apparatus. The attorneys for the Walker Company determined to oppose the motion for injunction on the ground that the Van Depoele patent 495,443 was invalid owing to a prior patent having been granted

Van Depoele, covering the same invention, in 1890. When the motion came up before Judge Cox in the Circuit Court, Judge Cox followed the decision of Judge Townsend and granted the injunction. An appeal was taken from this decision to the Court of Appeals. The plaintiffs claimed that the earlier patent was intended to cover the switching arrangements and the latter the under-running contact. This court, however, decided that the so-called broad Van Depoele trolley patent 495,443 was invalid on the ground that the prior Van Depoele patent of April 1, 1890, was for the same invention. The owners of the patent then shifted the ground of attack to two of its other claims, endeavoring to gain a favorable decision in this way.

In February last, Judge Lacombe of the United States Circuit Court decided in favor of the patent on the two new claims. The decision just rendered is in the Union Railway or "Huckleberry Road" case. It was a decision on a motion for a preliminary injunction, restraining the Union Railway from using the Walker Company's apparatus, but it is nevertheless controlling and conclusive with respect to the validity of the patent, and no appeal lies to any higher court. The earlier patent is still in force, but its claims are so narrow that it is practically worthless, at least so they were construed by the Circuit Court of Appeals in the "Elmira" case.

The recent decision makes the last controlling patent owned by the Trust worthless. In the General Electric Company's statement of its condition, recently filed with the Commissioner of Corporations in Boston, among its assets the patent rights are valued at \$8,000,000. It is safe to say that the patent rights owned by the General Electric Company are worth at the present time but very little.

* * *

The Trans-Mississippi and International Exposition.
From all accounts, the Trans-Mississippi and International Exposition, which is to be held at Omaha from June 1 to November 1, 1898, will be a great success. No efforts are being spared on the part of the management to make the Exposition everything that could be desired. The electrical features especially are being given careful attention. The lighting of the grounds and buildings has been consigned to the charge of Mr. Luther Stieringer, the well-known electrical engineer, who acted in the capacity of consulting engineer at the late Columbian Exposition in Chicago. In the Machinery and Electricity Building it is proposed to exhibit all the latest electrical and mechanical devices that are being manufactured both in this country and abroad, and undoubtedly many of the inventions that have been creating wide attention of late will form some of the attractions. The illumination of the grounds and buildings at

night will in all probability be one of the most interesting and striking features. A careful study of the illuminating plan shows a great array of incandescent lights. It is proposed to outline every building with the glowing bulb. Along cornices, around windows, on pillars, domes, and at the water edge incandescent lights will shine forth. At the west end of the lagoon, the salient points of the architecture forming the Government Building will be made distinct by electric starpoints. On either side the colonnades connecting the Government Building with the neighboring buildings will be defined by pillars of light. The Fine Arts Building with its domes encoirled with lights should make an attractive spectacle. But probably the feature of the nightly illumination that will attract the most attention will be the electric fountain, designated Nautilus. The latter, located in the center of the Mirror (a small lake) and surrounded by electric lights, will be constantly bombarded from an invisible source with light ever changing in color and of great intensity.

The Trans-Mississippi & International Exposition should prove of inestimable value from an educational as well as an industrial and commercial standpoint.

* * *

Locating Submarine Mines by Means of the Telautograph.

In a recent issue of the *Chicago Times-Herald*, Professor Elisha Gray, the inventor of the telautograph, describes at some length a very ingenious arrangement by which the telautograph could be adapted in coast and harbor defenses for locating the exact position of an enemy's vessel. In other words, by means of suitable electrical connections the device would serve as a range-finder. Referring to a conversation on this subject held with an army officer some years ago, Prof. Gray says:

"The plan then suggested by the writer contemplated an apparatus that would trace a line on a map of the harbor, or a section of the coast, that had been carefully surveyed and laid out into squares of a convenient size. If such an apparatus has been perfected and put into use since that time the writer does not know of it, and if it has not this article may help some one who is familiar with the details and requirements of harbor defenses to adapt such an apparatus to practical work. The value of such a system consists in being able at a glance to determine the exact position of a vessel at any moment—without calculation—by a direct reading."

At the time Prof. Gray originally suggested the above method a mathematical calculation had to be gone through before the exact location of a vessel could be determined. Since then however the Fiske range-finder, and still more recently the Lewis depression finder, have been developed and perfected, by means of which the distance between the observer and the object at which a gun is to be fired is automatically recorded. As will be seen from the following description, Prof. Gray's device is quite similar in its general arrangement to the Fiske range-finder, although the final results obtained differ somewhat. The system suggested by Prof. Gray necessitates the making of an extremely accurate survey of a harbor, dividing it up into convenient but imaginary squares and marking on the map in each of these squares the distance from the gun, the exact direction and the angle of depression. This map must be placed in a permanent position in such a manner that its meridional points exactly agree with the points of the compass of the harbor. The map should moreover be conveniently located with reference to the gun. The operation is then described by Prof. Gray as follows:

"Two points of observation are established on the shore of the harbor, so related to each other that the lines of observation will always cross each other at some angle when the observation glasses are both

directed to any single point on the surface of the harbor, or that section of the harbor that this particular station has charge of. These glasses are attached to a perpendicular standard or shaft that rotates in bearings, and means are provided for elevating or depressing the observation glasses as occasion requires. On the rotating standard is fixed a device for transmitting electrical impulses, and a certain number of impulses will always be transmitted for a given amount of rotation of the standard. These impulses represent equal steps, which may be as short as is desired. The equipments at each point of observation are exactly alike in construction and in electrical attachments. These two points of observation are the transmitting stations, and from each an electric wire is run to the map where the gun is located. At two points on the shore of the map that coincide exactly with the two transmitting stations on the shore of the harbor are mounted rotating standards, each of which carries an arm long enough to cover that section of the harbor map that it is designed to stand guard over. These arms should be light and no longer than is necessary to do the work. A ratchet wheel that is electrically controlled, having fine teeth, is carried by each standard carrying the arms. These wheels are moved step by step, the same as in the telautograph, by the electric impulses that come from the transmitters or the observing stations. There must be a means of unifying the transmitters with the receivers, the same as in the telautograph, and also a reversing mechanism. These devices are all worked out in the telautograph, so that they will only need to be adapted to this particular use. Now, if the two sets of apparatus are put in unison—which can be done in a second or two—and the two observers train their glasses upon some object located in the harbor, which we will say is in square 100 as marked on the map, it will be found that the point where the two arms of the receiver cross each other over the map will be in square 100, and in the exact part of the square that the object is in on the harbor. In fact, it is only a question of accurate survey and accurate construction of apparatus to locate an object to the fraction of a yard. . . . The movement of the observation glasses transmits electrical impulses to the corresponding arms over the map, causing them to move in the same manner—relatively. At the point where the two arms cross, a tracer is carried that may or may not trace a line on the map, whichever is desired. The two observers should be in telephonic connection, and both with the receiving station; and in order to be able to converse freely and at the same time have their hands free to move the observation glasses they should wear receivers fastened to the head, as they do in central telephone stations. The tracer will rest on the map in the same position that the ship occupies on the water, and will move as it moves. A station on a harbor fitted out with this apparatus and a disappearing gun could load and take aim behind the works and then elevate the gun and fire. If a harbor were filled with torpedoes or mines, and they were accurately located on the map, anyone could watch the indicator as it followed the movement of a vessel and when it was over a torpedo it could be instantly exploded by touching a button."

In the latter respect Prof. Gray's apparatus would be more desirable than the Fiske range-finder, as it could be utilized either for training a gun or firing a torpedo, whereas the range-finder could scarcely be made use of in its ordinary form in determining when a vessel was directly over a mine. A modified form of range-finder has however been designed for this purpose, which we described in a recent editorial and which in a word consists of two pivoted telescopes in circuit with a submarine mine, so arranged that when both telescopes are pointed directly at the mine the switches are closed and the mine exploded. As Prof. Gray's apparatus could be made to serve two purposes it should prove of great value. If, however, a harbor or other body of water was not

already mapped out into suitable squares, the necessary extremely accurate surveys would entail a considerable expenditure of both time and money.

Another method of firing a mine is by means of a camera obscura. An operator sits in a dark room in the outer wall of which a fixed camera is located. The lens of this camera would take in the entire view of the surface of a bay. The light admitted into the room by the lens would, by the aid of a mirror, be projected down on a chart on which each mine was accurately located and numbered. Any moving object on the surface of the bay or harbor would be reflected on this chart. If therefore an enemy's ship appeared on the chart, as soon as its reflection covered one of the numbers marking the location of a mine, the operator would close the circuit corresponding to that number, and the mine would be exploded.

* * *

The Electrical Exhibition.

As the time gradually approaches for holding the Electrical Exhibition in Madison Square Garden, the interest in the event is unquestionably growing. There would seem to be an idea prevalent in the trade that owing to the more or less unsettled condition of the country the Exhibition might have to be indefinitely postponed. Such however is not the case, as the management has determined that, even though further complications with Spain should arise, the holding of the Exhibition will not be interfered with in any respect, and the revised list of exhibitors which appears in this issue of *ELECTRICITY* would seem to guarantee a splendid showing. The management is sparing no pains to make this Exhibition attractive, having instituted a telegraphic competition, a typewriting contest and numerous other interesting events. The Madison Square Garden show should prove extremely fertile in exhibits new and as yet little known. The Diesel Motor Company are importing, so it is said, one of their prime movers from Germany with a view to showing its high efficiency in actual work at the coming Exhibition. Several new vacuum tube lights will also be shown in actual operation, and thus the public will have an opportunity of forming an opinion as to whether this new form of illuminant embodies the many advantages claimed for it. A large number of the latest and most important inventions will undoubtedly be shown.

Under the Searchlight.

Notes and Comments on Various Topics.

"Progressive Eucbre."

A careful perusal of the following notices, with a glance at the dates, which have appeared from time to time in various papers, will show what these hopeful and cheerful little effusions amount to:

(*Boston Advertiser*, March 23.)

It is said by people who claim to be usually well informed in matters connected with the General Electric Company that the plan to adjust the claims of the preferred stockholders is practically matured, the official notice of which may be given out in the near future. The purpose of the directors, it is reported, is to offer about three shares of common stock for one of the preferred, comprising the back dividends on the latter. Direct verification of these reports, however, cannot be obtained.

The fiscal year of the company ended January 31 and the annual report may be expected during the latter part of April, just previous to the annual meeting, which is held the second Tuesday in May. The last dividend on the preferred stock was paid in July, 1893, and up to January, 1898, the accumulated payments amounted to 81½ per cent, which must be paid before the common stock can receive anything.

(*Boston Advertiser*, March 31.)

It is said that the plan for putting General Electric in a condition for paying full dividends is well matured, if not entirely matured. The latest information is that the company proposes to give the preferred stock debenture bonds in full settlement of their claims, if not in full exchange for their stock. It seems that the company in retiring its debenture bonds in past years has held them uncancelled

and can therefore release them if necessary. When the preferred stock is out of the way it is rumored that the common will be put in two and dividends on a 6 per cent. basis be undertaken on this new stock.

(Boston Advertiser, April 5.)

A meeting of the preferred stockholders' committee of the General Electric Company was held in Boston, Saturday, at which, it is understood, an amicable agreement has been reached for settlement of the accumulative dividend question. The seven millions of this stock is now entitled to something over 50 per cent. back dividends.

(Boston News Bureau, April 6.)

If the General Electric Company should settle with the preferred stockholders and correct the impairment of capital by reducing the common stock 50 per cent., and it should cost \$100,000 a year to do this, there would be left for the new stock on the basis of 1897 earnings, ignoring amounts charged off, a sum equivalent to 7½ per cent. Taking only the actual surplus last year, and allowing for the preferred dividend and \$130,000 cost of settlement, there would be left for the new common stock 3.7 per cent. The company is known to have done much better in 1898 than it did in 1897. On the basis of earnings for the last three years there is no question that General Electric could pay the full preferred stock dividend and at least 4 per cent. on one-half the present common stock. There is little doubt that the affairs of the company will be straightened out soon and favorably to both classes of stockholders.

(N. Y. News Bureau, April 7.)

While it has been rumored that an agreement has been reached between the common and preferred stockholders of the General Electric Company for a settlement of all their differences, an important interest concerned in the negotiations says positively that no such agreement has been reached. It is admitted that the matter pertaining to a settlement has been under discussion for several months past between committees of the common and preferred stockholders, but no agreement has been reached, and the whole matter has again been referred to the lawyers in whose hands it has been for the last two years.

From the last item, notwithstanding the excellent work of the General Electric Company's press agent, it will be seen that absolutely nothing has been done in regard to arranging a settlement of the accumulated dividends. In other words, the stockholders are invited to be patient for another three or four years or so.

* * *

"Corporations for the Consumption of Stockholders."

The following, contributed to the *U. S. Investor* by "Constant Reader," is so much in accord with our own views as they have been expressed time and again in regard to the General Electric and other stock jobbing concerns which have inflicted incalculable injury on the electrical business, that we reproduce it simply as a verification of our own views by one who is apparently well informed. It is addressed to the editor of the *Investor*:

The *Boston Herald's* financial article of Sunday last speaks of "corporations for the consumption of stockholders," a phrase which very pitifully describes a large number of our financial concerns, which may with advantage be enlarged upon. There are corporations created solely for that purpose. These are, on the whole, less numerous and less dangerous than the corporations in which the consumption of stockholders is simply one of the incidental objects of the promoters and managers.

There is nothing which has been so disastrous to the country and the people of this country for a generation as this nefarious industry, as there has been no industry in the United States so enormously profitable or on the whole so safe. . . . Since then the methods have been perfected, and taking advantage of the timidity of the stockholders, and the general complacency and sometimes the corruption of the courts of justice, the industry has been developed to the further corruption of our political life, and our financial system generally. Of the great fortunes that have been built up since the civil war, it is speaking within limits to say that a great number have been amassed by this method of wrong and robbery. Corporations of almost every kind have been and are diverted from their ostensible objects by trusted officials and managers, to the end of swindling the holders of the stock. The thing has become so common, and in financial circles so well recognized, that even in the most glaring and shameless instances it hardly attracts attention, or involves any loss of reputation or social standing.

Why is this state of things allowed? The explanation of a most respectable Boston broker is: "Because the stockholders are damned fools." The stockholders in general may be fools, but those who manage corporations for the consumption of stockholders are knaves—a sort of high-grade confidence men, vastly more dangerous, if not worse, than bunco steers and gold-brick men. They live in luxury and honor, and have memorial churches and universities erected to them after death, with glowing eulogies

from the writer of obituary notices; but they ruin the widow and the fatherless, and are the worst enemies of the prosperity, and in the long run, the liberties, of the people.

* * *

ACCORDING to the *New York Mail and Express*, the votaries of electrical science "express their feelings now and then in singular ways. One gentleman has in his sitting room in this city a revolving glass disk with cushions which generate electric sparks. When the mechanism is in motion there is a torrent of sparks between two brass conductors attached to the contrivance accompanied by a fusillade of tiny reports. He claims that it produces ozone and prevents the headaches from which he formerly suffered. A woman with the same fad has a bedstead, washstand and three chairs made of iron decorated with brass. The iron is magnetic and she believes that it exerts a beneficial influence upon her nerves and brain, inducing sound sleep and strengthening all the tissues of her body." No wonder the originator of such fakes as electric belts, shoes, etc., prosper.

* * *

It is really surprising the new uses to which electricity is constantly being adapted. In all probability the public will before long be drinking (except the Prohibitionists, of course,) electrically treated wine. This is accomplished by means of carbon electrodes, the positive being placed in a cylinder containing diluted alcohol and separated from the wine by a diaphragm. The negative electrode is placed directly in the wine and the hydrogen generated by the current destroys the acid. It is stated that wine treated in this manner can acquire in a few hours properties that would otherwise consume a long period of time.

* * *

FRANK J. SPRAGUE, vice-president of the Sprague Electric Company and a graduate of the U. S. Naval Academy, is said to be organizing an emergency corps of electrical engineers to work in conjunction with the State Naval Reserve in the event of war. His plan is said to have the endorsement of Mr. Roosevelt, Secretary of the Navy. Electricians desiring to learn more about this movement can do so by writing to Room 1,511 Commercial Cable Building, New York.

* * *

THE French steamer *La Gascogne* brought over on its last trip two electric racing machines which are said to be creating quite a stir in America's cycle racing circles. The electric tandem has a motor weighing 25 kilogrammes (55 lbs.) attached to the lower tube of the frame. The necessary current for operating the motor is obtained from a number of storage batteries grouped in four boxes above the motor. A current ranging from 1 to 80 amperes can be obtained. It is claimed the machine will travel at the rate of 40 miles an hour for three quarters of an hour with one battery charge. A bond of \$500 must be given before the owners will be allowed to take the machines from the Custom House.

* * *

THE *New York Sun* is responsible for the following: "In a brief visit to the borough of Brooklyn the other day," said a Manhattan boroughite, "I saw on the fender of a trolley car a single sheet poster printed with the announcement of a theater. I should think that as billboards the fenders of trolley cars would serve admirably, especially for pictorial work for circuses, for instance. A trolley car with its fender covered with pictures of lions and tigers and so on, coming toward the beholder at a high rate of speed, could not fail to be impressive."

An Easter Souvenir.

The American Electrical Works, Providence, R. I., Eugene F. Phillips general manager, never fails to commemorate the cherished festivals of church and people by some pleasant and ingenious device appropriate to the occasion or suggestive of its spirit. The

Easter souvenir which the company sent out this year for the delectation of its multitude of friends and customers is quite pretty. It is an ornamental card handsomely printed in green and red, the two ends folding over a flap which represents an egg-plant in shape and color. When this flap falls back, a miniature crimson envelope is disclosed, which on being opened is found to contain some seeds of the plant. The idea is set forth so well and so pleasantly in the remarks printed on the card that we cannot resist giving them in full, as follows:

EASTER.

We desired to send you some souvenir at this joyous Easter time. The problem was, what to send.

Should we send lilies? They would wither before you could receive them.

The sending of a colored egg was suggested. Well you can imagine the condition in which an egg would reach our friends if sent through the mails. A happy thought suggested itself.

An Egg—An Egg Plant.

So here you have it. Upon opening the egg-plant you [Here is given the semblance of an egg-plant.]

find the seed. It seems to us a beautiful and suggestive idea to request each of our good friends to plant the enclosed seed, and from it raise a

Commemorative Egg Plant

with the hope that its growth and fruit may frequently bring to mind your friends,

AMERICAN ELECTRICAL WORKS,

Best equipped and largest plant in the United States for bare and insulated electric wires.

THE LATEST TROLLEY LITIGATION.

The Circuit Court of Appeals Reverses Judge Lacombe's Decision in the Walker Suit—The Under-Running Trolley Open to All—The Best Patent Asset of the G. E. Wiped Out—A Trolley Case in Cincinnati.

In the suit of the Thomson-Houston Electric Company against the Union Railway Company, New York, the United States Circuit Court of Appeals has reversed Circuit Judge Lacombe's decision, in which he granted an injunction pending final hearing in the case, restraining the railway company from using certain overhead trolley car appliances to which the plaintiff claims exclusive right under the Van Depoele trolley patent. The Union Railway Company is using the Walker Company's apparatus, and the officers of the latter company state that under the decision the right to make and use the trailing freely mounted trolley arm pressed up against an overhead conductor is now no longer limited to the General Electric and Westinghouse companies and their licensees.

In the United States Circuit Court of Appeals at Cincinnati on the 5th inst. argument began in the case of Oliver S. Kelly and the General Electric Company vs. the Springfield (O.) Electric Street Railway Company. The case under consideration involves the validity of the patent on the single trolley street-car system. It was tried in the court below before Judge Sage and was decided in favor of the defendants and the complainants have appealed. Alluding to the case the Cincinnati *Enquirer* says: "The litigation really began in 1880 in the Patent Office, by interference proceedings instituted by Edison of Menlo Park; Field, of Stockbridge, Mass., and Siemens, of Berlin, Germany. Green, of Kalamazoo, Mich., was the one who sought to have the invention patented, and after a long litigation the United States Supreme Court decided in his favor, and in 1893 the present suit was begun in the Circuit Court for this district. In speaking of the case, Attorney Dowell [counsel for the G. E. Co., who is assisted in the appeal case by F. P. Fish] stated that Green's first model appeared in 1856, and then in 1875 he built an electric street railway 200 feet long and placed thereon a car large enough to carry at least one person, and this was in fact the first electric street railway in existence used to carry passengers. The defendants have on hand among their exhibits a reproduction of the model of an engine claimed to have been in use in 1840. They also have two or three other models nearly as old as this one. The case will be bitterly fought in the Court of Appeals, and the outcome will be watched with interest."

REVISED PARTIAL LIST OF EXHIBITORS

At the Second Electrical and Kindred Industries Exhibition (held under the Auspices of the New York Electrical Society), Madison Square Garden, New York, May 2 to May 31, 1898:

Armstrong Interior Conduit Co., Pittsburg, Pa.
 American Rheostat Co., Milwaukee, Wis.
 American Pulley Co., Philadelphia.
 American Watchman's Time Detector, 231 Broadway, New York.
 American Engine Co., Bound Brook, N. J.
 Adams-Bagball Electric Co., Cleveland, Ohio.
 Arrington & Sims Co., Providence, R. I.
 American Electrical & Maintenance Co., 451 Greenwich st., New York.
 American Electrician Co., New York.
 American Electrical Works, Providence, R. I.
 American Electric Novelty & Manufacturing Co., 231 Broadway, New York.
 American Circular Loom Co., Boston, Mass.
 Bullock Electric Co., St. Paul Building, New York.
 Bosert Electric Construction Co., Utica, N. Y.
 Baylis Co., The, 99 Cedar st., New York.
 Borne, Sorymser Co., 80 South st., New York.
 Belknap Motor Co., Portland, Me.
 Brewster Engineering Co., 27 Thames st., New York.
 Barrows & Co., C. H., 302 West 53d st., New York. (Electric Vehicles.)
 Broomell, Schmidt & Co., York, Pa.
 Boston Electric Duct Co., Boston, Mass.
 Burhorn & Granger, 136 Liberty st., New York. (Woodbury Engine.)
 Babcock & Wilcox Co., 29 Cortlandt st., New York.
 Crocker-Wheeler Electric Co., 39 Cortlandt st., New York.
 C. & C. Electric Co., 143 Liberty st., New York.
 Corey, R. B., 26 Cortlandt st., New York.
 Cobo & Co., H. B., 220 Broadway, New York.
 Card Electric Co., Mansfield, Ohio.
 Camp Co., H. B., Aultman, Ohio.
 Cleveland Twist Drill Co., Cleveland, Ohio.
 Crouse-Tremaine Carbon Co., Fostoria, Ohio.
 Crown Woven Wire Brush Co., Salem, Mass.
 Cook's Sons, Adam, 313 West st., New York.
 Cutter Elec. & Manufacturing Co., Philadelphia.
 De La Vergne Refrigerating Machine Co., 138th st. & East River, New York. (Hornshy-Akroyd Oil Engine.)
 Diamond Electric Co., Peoria, Ill.
 Diesel Motor Co., 11 Broadway, New York.
 Edison, Thomas A., Orange, N. J.
 Edison Electric Illuminating Co. of N. Y., Duane and Elm streets, New York.
 Eddy Electric Manufacturing Co., Windsor, Conn.
 Electric Storage Battery Co., Philadelphia.
 Excelsior Electric Co., Brooklyn, N. Y.
 Edison Manufacturing Co., Orange, N. J.
 Edison, Jr., Thomas A., 96 Broadway, New York.
 Electrical Engineer, New York.
 Electrical Review, New York.
 Electrical Age Publishing Co., New York.
 Electricity Newspaper Co., New York.
 Electrical World, New York.
 Elliott & Hatch Book Typewriter Co., 253 Broadway, New York.
 Electrical Engineer Institute of Correspondence Instruction, 120 Liberty st., New York.
 Fischer Foundry & Machine Co., Pittsburg, Pa.
 Fort Wayne Elec. Corporation, Fort Wayne, Ind.
 Fuel Economizer Co., Matteawan, N. Y.
 Fostoria Incandescent Lamp Co., Fostoria, Ohio.
 Fiberite Co., Mechanicsville, N. Y.
 Fairchild & Sumner, 39 Cortlandt st., New York.
 Francis Bros., Philadelphia, Pa.
 Gold Car Heating Co., Cliff & Frankfort sts., New York.
 Garton-Daniels Electric Co., Keokuk, Ia.
 Garvin Machine Co., Spring and Varick sts., New York.
 General Incandescent Arc Light Co., 33d st. and 1st avenue, New York.
 Griffing Iron Co., A. A., Jersey City, N. J.
 Harrison Safety Boiler Works, Germantown Junction, Philadelphia, Pa.
 Highland Chemical Co., Connellsville, Pa.
 Haines Co., Wm. S., Philadelphia, Pa.
 Haring Steam Plant Equipment Co., 26 Cortlandt st., New York.
 Hope Electric Appliance Co., Providence, R. I.
 Ideal Electric Corporation, 13th and Hudson sts., New York.
 Imperial Porcelain Works, Trenton, N. J.
 India Rubber & Gutta Percha Insulating Company, Glenwood, N. Y.
 International Air Lamp Co., Mercer and Houston sts., New York.
 Jones & Son, J., 69 Cortlandt st., New York.
 Kenfel & Esser Co., 127 Fulton st., New York.
 Kelley & Sons, B. F., 81 Liberty st., New York.

Keystone Electrical Instrument Co., 9th st. and Montgomery ave., Philadelphia.
 Keiley & Mueller, 7 West 13th st., New York.
 Kosmin O I Filter Co., Easton, Pa.
 K. & W. Company, Pittsfield, Mass.
 Ka zenstein & Co., L., 357 West st., New York.
 Kensington Engine Works, Ltd., Philadelphia.
 Kirkland, H. B., 120 Liberty st., New York.
 Lewis Tool Co., 44 Barclay st., New York.
 Lynn Incandescent Lamp Co., Lynn, Mass.
 Morris, Elmer P., 15 Cortlandt st., New York.
 Machado & Roller, 203 Broadway, New York.
 Mowrey, P. M., & Co., 318 Broadway, New York.
 Monarch Manufacturing Co., Waterbury, Conn.
 Niles Tool Works Co., Hamilton, O., and New York.
 National Meter Co., 118 Chambers st., New York.
 Nowotny Electric Co., Cincinnati, Ohio.
 National Carbon Co., Cleveland, Ohio.
 Nash Gas Engine Co., 99 Cedar st., New York.
 New Britain Machine Co., New Britain, Conn.
 N. Y. Safety Steam Power Co., 30 Cortlandt st., New York.
 N. Y. Car Wheel Works, Buffalo, N. Y.
 N. Y. Telephone Co., 18 Cortlandt st., New York.
 Oswego Boiler Works, Oswego, N. Y.
 Otis Electric Co., 38 Park Row, New York.
 Onondaga Dynamo Co., Syracuse, N. Y.
 Paragon Arc Lamp Co., Boston, Mass.
 Peru Electric Manufacturing Co., Peru, Ind.
 Peckham Motor Truck & Wheel Co., 26 Cortlandt st., New York, and Kingston, N. Y.
 Partrick, Carter & Wilkins, Philadelphia.
 Paragon Electric Fan Motor Co., 39 Cortlandt st., New York.
 Porter & Remsen, 39 Cortlandt st., New York.
 Prindle Pump Co., 136 Liberty st., New York.
 Partridge Carbon Co., Sandusky, Ohio.
 Pope Manufacturing Co. (Motor Carriage Department), Hartford, Conn.
 Platt Manufacturing Co., O. S., Bridgeport, Conn.
 Roebling's Sons Co., John A., Trenton, N. J.
 Riker Electric Motor Co., 45 York st., Brooklyn, N. Y. (Electric Vehicles.)
 Safety Insulated Wire & Cable Co., 229 West 28th st., New York.
 Stephenson Co., Ltd., John, 47 East 27th st., New York.
 Silex Insulation Co., 39 Cortlandt st., New York.
 Sprague Electric Co., 20 Broad st., New York.
 Simonds Manufacturing Co., Pittsburg, Pa.
 Sinclair, D. J., Caledonia, N. Y.
 Street Railway Journal Co., New York.
 Street Railway Review, Chicago.
 Shaw, H. M., 126 Liberty st., New York.
 Samson Cordage Works, Boston, Mass.
 Translucent Fabric Co., Quincy, Mass.
 Thomas & Sons Co., R., East Liverpool, Ohio.
 United States Electrical Supply Co., 141 East 25th st., New York.
 Universal Electric Co., 126 Liberty st., New York.
 Vacuum Oil Co., Rochester, N. Y.
 Van Horne, Burger & Co., Dayton, Ohio.
 Worthington, Henry R., New York.
 Walker Co., Cleveland, Ohio.
 Weston Electrical Instrument Co., Newark, N. J.
 Warren Electric Mfg. Co., Sandusky, Ohio.
 Williams & Co., J. H., Brooklyn, N. Y.
 White, J. G., & Co., 29 Broadway, New York.
 Western Electrician, Chicago and New York.
 Worthington Water Tube Boiler, 30 Cortlandt st., New York.
 Williams, J. P., 39 Cortlandt st., New York.
 Warren-Medbery Co., Mechanicsville, N. Y.
 Wilday, J. H., 23 Duane st., New York.
 Warren Electric and Specialty Co., Warren, Ohio.
 Zmdars & Hunt, 127 Fifth avenue, New York.
 Ziegler & Co., Boston, Mass.

ELECTRICAL EXHIBITION NOTES.

AN INTERESTING EXHIBIT.

The Brooklyn Polytechnic Institute and Dr. Samuel Sheldon, its Professor of Physics and Electrical Engineering, have kindly loaned the Electrical Exhibition several interesting units and standards upon which precision in electrical measurements is based. Even the electric public, while it hears a great deal of such standards rarely sees them, and this exhibit therefore will be at once of technical and popular interest. The exhibit will include especially some standards from the German Imperial Physico-Technical Institute (Reichsanstalt), whose celebrated work has been done under the guidance of such men as Helmholtz and Kohlrausch, and it is probable that these standards have never before been exhibited in this country. Dr. Sheldon will show the Reichsanstalt form of the standard Clark cell, the Reichsanstalt pattern of photometer, with Hefner amyloacetate standard lamp and Lummer-Brodhnn contrast

screen, standard .01 ohm for carrying heavy currents, large standard compensation set for the precise comparison of voltages from .01 to 1,200 volts and currents of any magnitude, standard Wheatstone bridge, Thomson's double bridge for conductivity measurements, standard Carhart-Clark cell, etc. The exhibition of such apparatus and the explanation given as to its use will do much to bring electrical measurements within the comprehension of the public, and to demonstrate the wonderful refinement of accuracy that modern electricians aim at in their apparatus.

Costly Litigation.

The Cincinnati Enquirer of the 3d inst. contains the following item:

"Mr. J. C. Harper, appointed special master in the Main Street Electric Railway controversy to pass on the claims of attorneys for fees, yesterday afternoon filed his report in the Circuit Court. E. A. Ferguson asked for \$10,000, and is allowed \$6,000; Messrs. Humphrey & Davies asked for \$6,000 and are allowed \$5,000; St. John Boyle asked for \$6,000 and is allowed \$4,000; Outcalt & Granger asked for \$7,500 and are allowed \$3,500; Follett & Kelly asked for \$6,250 and were allowed \$3,500; the Louisville Trust Company asked for \$1,000 and is allowed \$2,500; W. A. Goodman, trustee, asked for \$2,000 and is allowed \$500; Thornton M. Hinkle asked for \$500 and is allowed \$350. The claim of M. H. Winkler for \$500 is disallowed because Manager H. P. Bradford, who employed him, had no authority for so doing. The above claims are for services rendered in the litigation and foreclosure of mortgaged property."

Electrical Engineering Schools United.

The Correspondence School of Technology and the Institute for Home Study of Engineering, both of Cleveland, O., have recently united under the name of the Institute for Home Study of Engineering. Mr. E. P. Roberts is Technical Director, Mr. F. D. Leslie Business Director, and Mr. J. N. Norton Secretary and Treasurer.

A descriptive catalogue has recently been issued by the Institute in which the consolidation and method of teaching are set forth. The announcement says:

"One frequently sees in technical papers advertisements of 'A College Education by mail.' So far as we know, this is the only institution giving correspondence courses in engineering that does not make some such extravagant statement. Neither this nor any other correspondence school is giving by mail courses equal to those of the average technical college. We believe, however, that we are giving the most thorough courses to be had by this method of study. The men having the courses in charge are consulting engineers of repute, who have proved themselves to be capable specialists."

Personal.

Mr. Chas. A. Boyd on the 12th inst. resigned his position of superintendent of the Walker Company of Cleveland, O., and will enter business for himself, doing general engineering, with offices in the American Trust Building, Cleveland. Mr. Boyd had been with the Walker Company four years, starting as engineer in the railway motor department, having charge of the design and construction. About one year later he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on January 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

The General Electric Company owed on January 1, 1898, \$1,329,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

INSULATION AND CONDUCTION.*

BY REGINALD A. FESSENDEN.

(Concluded from page 198.)

For insulating the coils of resistances it is doubtful if we have any good solid material. Paraffin cannot be used, as its expansion and contraction are so great that large pressures are put upon the wire and the resultant strains change the resistance. It might be easy enough to prevent the strain on the first solidification in a way similar to that devised by Rowland for cementing flat mirrors without buckling them, i. e., by mixing a little glycerine with the beeswax; the glycerine not dissolving in the beeswax makes it act like a viscous fluid, i. e., deform under the action of infinitesimal forces in time. The glycerine however finally works its way out like zinc in a resistance alloy (as first pointed out by Mr. Weston), and if a similar method were used with the coils, it would still be subjected to strains on change of temperature. Another objection which has been made in England is that paraffin absorbs moisture. It is possible that this is due to the dissimilar methods of producing American and English paraffin as I have never had to complain of this, except of course when cold paraffin was placed in saturated, moist air. The insulation resistance of paraffin seems however to be markedly increased by the treatment mentioned below. The great objection to paraffin is its tendency to collect dust. Shellac has been recommended, and since the coils are in the dark the material will oxidize but slowly, and if care be taken to use pure alcohol for a solvent, and not denaturalized spirit (which sometimes contains conducting impurities), has a very high resistance when dry. Some forms of Japan lac seem to remain flexible permanently, as for instance the sample *a* (composition unknown) which is ten years old.

Oil is sometimes used for resistance coils, and this is without doubt the best method, since the great point in the use of resistance coils is to know their temperature. The writer's experience with manganin and constantin as practical laboratory standards has been unfortunate, and he has hence decided to use only standards of pure lead run into glass tubes and kept in water. The reason is that, other things being equal, the most sensitive Wheatstone bridge is that which takes the greatest current without appreciable heating, and in the ordinary form of resistance coil a very small current will heat the interior up to such a temperature as to alter the value. Moreover, if the coil is of a material not affected by such changes of temperature, it (with our present alloys) will have a larger temperature coefficient, and as the temperature of the interior of the coil is not known this introduces another uncertainty. With the oil mounting this is all done away with, and pure oil has a very high resistance for low voltages.

For condensers and induction coils it is not only necessary to have materials of great ohmic resistance and of great dielectric strength, they must also be perfectly pure and free from admixture. For the first two properties there is nothing so good as paraffin when properly used, all compositions such as beeswax (oerotic acid), etc., being quite inferior in both respects. Paraffin, and what is practically the same thing, pure ozokerite, will stand according to the tests of Mr. Chesney, which I had the pleasure of witnessing, at the rate of 500,000 volts per inch. This I have confirmed up to 60,000 volts, alternating. Most substances, such for instance as glass, are at once out of consideration from the fact that they have too much electrical absorption and heat when subjected to a fluctuating voltage.

We must have an electrically homogeneous dielectric, i. e., one of the same specific inductive capacity all through. This is for two reasons. First, because if we have a dielectric *A* between two charged conduct-

ors, the introduction of a dielectric of greater specific inductive capacity, even if of infinite dielectric strength and ohmic resistance, will cause *A* to break down. To take a numerical case—suppose we have two plates, 1 cm. apart, and attached to the terminals of a 10,000 volt A. C. dynamo (Fig. 5). Suppose the dielectric, air, to support 50 per cent. more than this pressure. Introduce two plates of glass of $K = 8$, each $\frac{1}{2}$ cm. in thickness. Since the voltage divides itself up inversely to the capacitance, we will now have 8,889 volts between *c* and *D*. This being at a rate of 17,778 volts per cm. and as it only supports 15,000, we will get a spark between *c* and *D* at every reversal of the voltage which will quickly heat the glass and make it conduct. The full potential of 10,000 will then be between *c* and *D*, and a regular arc will form. Thus we see that the introduction of a good insulator will, in all cases where an intermittent or alternating voltage is used, have the paradoxical effect of weakening the insulation, unless the whole space is filled up with the material. This weakening is not generally apparent at once, as the spark takes some time to eat its way back, and this explains why many induction coils only last for a few years of operation.

Another cause is that treated of by Poisson, Clausius and Maxwell.* This is, that layers of dielectrics of different capacities and resistances show electrical absorption, and this theory has been proven experimentally by Muraoka, who showed that by taking two fluids, neither of which showed absorption, a layer of one on top of the other did do so. Maxwell treated the general case. It has, however, been treated in a more specialized way in *La Lumiere Elec.*, 1891. In this paper are brought out the following points:

1. A dielectric, as in Fig. 6, containing conducting particles of water, for instance, may be considered as an arrangement of condensers and resistances in series and shunt with each other. Two cases, shown in Figs. 7 and 8, are worked out, and Fig. 9 gives the curve of charge in the cases of Fig. 7; *E* is the voltage on the condenser part, and *E'* that on the condenser and resistance.

2. A condenser can show large residual charge, though its true ohmic resistance is infinite.

3. With dielectrics showing absorption there will be found some discharge time at which the amount of discharge will be constant at all temperatures.

4. Why in some tests insulation seems to be lower with higher voltages.

5. Why the presence of conducting particles increases apparent capacity.

6. That to get true ohmic resistance of most dielectrics, voltage must be kept on for a long time, even for days.

7. Why Siemens' method of taking the rate of loss of charge by electrometer does not give correct results.

8. That specific inductive capacity of such dielectrics can only be determined by rapidly alternating currents. This possibly explains an effect noticed by the writer many years ago, i. e., that an A. C. static wattmeter immersed in water did not give anything like the torque it should have if the true value of *K* for water were 80.

9. The importance of getting out the last traces of water in guttapercha and paper when used for cables.

As mentioned, this author considers a simple case of Maxwell's general theory and proved the above results by making actual measurements on condensers and resistances connected up so as to correspond to a simple case of a dielectric of high resistance with conducting particles in it. This paper should be read by all electricians, especially those concerned with cable work. I would like to speak of this subject more in detail, but for lack of time will only add that most of the conclusions in that paper have been confirmed by me, and that some which had been arrived at independently were seen to be in perfect agreement.

It is this absorption and the consequent losses which make glass useless as an insulator against high A. C. voltages. In some experiments made by Messrs. Stanley and Chesney which were shown me, the glass plates of the condenser when on an A. C. voltage (though thick enough to have stood ten times the D. C. voltage), after a few moments got hot, sparks could be seen passing inside the glass, and the plates finally broke down. Glass is not homogeneous, as it is made up of a number of substances, some much better conductors than others, and of different capacities and all stirred together but not dissolved. This is shown by the care which has to be used in getting glass homogeneous enough for optical purposes, it even having, as been told me by Mr. Brashear, to be kept perfectly horizontal when annealing, as the heavier parts tend so much to sink down to the bottom, even when the glass is only plastic, that the only way to do is to keep the levels of different density parallel to the surface of the dielectric so that their effect on the light will be as equal as possible for all rays. Otherwise one side of the lens would be of heavy glass and the other light, while at present it is so arranged that one face is dense and the other light. Mica is much less objectionable, especially if its cracks are filled up and it is well dried. Paraffin when properly treated makes very good condensers. The old method of piling together pieces of paraffin paper and tinfoil and then pressing them, left much air and moisture inside. This produced large electrical absorption and gave large capacity. Messrs. Hutin and Lablanc were the first to discover that good condensers could be made by heating such condensers till the moisture and air were expelled. Their results* showed that the specific inductive capacity of this more homogeneous dielectric could be reduced from 8 to 2.5. I have myself found it come down as low as 2. They then found that the same results could be obtained by heating the paper before making up the condenser. Since then, this method of forming condensers by heating them to expel moisture, air and acid has been used quite generally, with some modifications and improvements resulting in a shortening of the process.

It may be said as a general rule that the capacity of all substances showing absorption may be reduced by this treatment if the heating be kept up long enough. A great many oils, for instance, are given high capacity, but I have found that in many cases this can be greatly reduced by this method, and that the slight remaining excess of *K* over that called for by Maxwell's theory can be almost entirely removed by removing the free fatty acids, mucins, etc. Oils tested by me were olive, castor, linseed and cottonseed. All these have very high insulation resistance and low specific capacity when so treated and purified, but they soon lose this again when exposed to air. It is evident, therefore, that the anomalous results obtained by Hopkinson and others were due, in some cases at least, to impure material, and such results must be considered as forming a strong proof of the correctness of Maxwell's theory.†

But when the substances are not themselves solid, but viscous, they must have a mechanical backing. For this pure cellulose is generally used. Pure cellulose contains some loosely combined moisture. Consequently it can exist in two states. Dried below 100° C. it decreases its specific inductive capacity very much, and has very high resistance and is flexible. Kept above 100° C. for any length of time it loses some of its combined water, has a much higher ohmic resistance and its specific inductive capacity sinks to 1.9 or 2. It however becomes very brittle, and even though the temperature be only a few degrees above 100° C. it finally cannot be bent without breaking. (This brittleness must be carefully distinguished from the so-called rottenness which

* Paper read before the 123d meeting of the American Institute of Electrical Engineers, New York, March 23, 1898.

** "Elec. and Mag.," Vol. I, Chapter 10.

* *La Lumiere Elec.*, July 25, 1891.

† A rule connecting this effect with the sign of the Kerr electrostatic optical effect has been given by the writer, in *Elec. World*, Jan. 2, 1897.

cotton fabrics get when dipped in linseed oil and dried. The fact that cotton tears easily in such a condition is due to the same cause as makes a wire mosquito netting tear when painted, i. e., the fibers are stuck fast by the varnish and cannot help one another. This can be proven by removing the dried oil, when the fiber will be found to have nearly its original strength.) In this condition it is best suited for making condensers. The paraffin itself is greatly improved, as was pointed out by Hntin and Lablanc, by heating to about 140° C. Three hours' heating I have found satisfactory. The dried paper, immediately on removal from the oven, is plunged into the hot paraffin, so as to protect it from absorbing moisture. The condenser is then made up and boiled, so as to remove the air, for several hours. This boiling method was described in a recent patent as a novelty, but it was used by Mr. Chesney at Pittsfield in 1891.

A condenser so made, if perfectly pure cellulose is used (perfectly pure paper is used in practice), and with pure paraffin, will stand 250 volts per thousandth of an inch when the dielectric is less than .01 inch, and at a higher rate for greater thicknesses when the effect of small defects in one sheet of paper is not so serious.

Practically the same remarks apply to the making of induction coils. Here, however, we meet with the great difficulty that the paraffin in cooling is sure to shrink, and will leave hollows inside. The way to get over this is to construct the coil so that when cooling the shrinkage will take place outside, just as if one were making a casting of some metal having great contraction. The coefficient of adhesion also should be less between the walls of the mould and paraffin than between the wire and paraffin; also the outside should never be let harden first, as then, of course, a hollow space is left inside. Another precaution is to expel all gases by heating the paraffin for some time above the temperature at which the coils are to be boiled. The coils should be boiled above 100° C. for some hours to drive off the loosely combined water. This destroys the mechanical strength of the cellulose, but as the whole coil forms a solid mass this is of no great consequence.

Silk should never be used where high insulation is required, as pure cellulose dry and boiled in paraffin is so much superior to it that there is no comparison. With pure cellulose, coils with only 1,700 feet of wire per inch of spark stand perfectly, i. e., the spark may be five times longer than the coil. In ordinary use, coils having a spark length 3½ times that of the coil have been run for long periods with no break-downs.

As regards oil insulation for ordinary induction coils, the writer has not had sufficient practical experience. I believe, however, that very good results are obtained. With regard to the Thomson high-frequency coil,* there is no question of the efficacy of oil there, especially with regard to ease of repair. As is well known, however, the oil and coil should always be heated above 110° C. for some time if the best results are to be obtained. A very curious increase of insulating power for high frequencies in oil has been noted by Elihu Thomson, who has suggested that it might be due to inertia of the molecules of oil. To test this, one of the writer's students, Mr. Bennet, constructed a two-phase high-frequency electrostatic field. Though insulators placed in this rotated even when placed within a 1/16 inch glass flask, the effect was found to be due to air currents, and when these were eliminated no movement was obtained, so that the cause of this effect is still unknown, and it is doubtful if true dielectric hysteresis has ever been observed.

So far as Mr. Chattock's experiments and the experience of the writer go, there is not a great deal of difference between the dielectric strength of different substances. It is probably related to the tensile

strength. As mentioned previously, the writer* pointed out that there was strong evidence to show that the tensile strength of a substance was due to the mutual attraction of charges in the atoms and that the observed values agreed well with the calculated and followed the same law. Some time later Chattock† in a very interesting and able paper showed that, as the results of his experiments, the dielectric broke down when the slope of potential was great enough to pull apart atoms having charges of the same dimensions as the ionic charges. This was shown for gases, fluids and solids, and forms a very interesting—and, I believe, independent—corroboration of the writer's electrostatic theory of

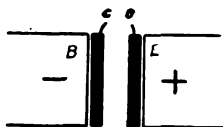


FIG. 5

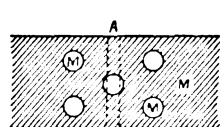


FIG. 6

cohesion. Consequently, the nearer the atoms are together and the greater their rigidity, the greater also their dielectric strength.

Chattock's experiments give for solids and fluids—

Substance.	Volts per cm. for breaking down.
Glass.....	919,000
Water.....	1,050,000
Oil.....	930,000

which agrees well with the theory.

From the above it will be seen that if the materials are pure, and ohmic resistance is of not much importance, a compound having its molecules held together tightly will have good dielectric strength for D. C. voltages.

This paper is already so long that I cannot touch in detail on the question of cables. There are also other papers in existence written by men better equipped for the task. I had intended saying something about what Siemens has called the "absurd craze for high insulation resistance," but the fact is now generally recognized, except by inexperienced engineers, that the best cables are those of medium ohmic resistance. I will only mention two methods which have occurred to me as feasible for certain purposes. One is based on the fact that the dielectric strength of air, as shown by the experiments of J. J. Thomson and Peacor, increases very rapidly with the pressure at 90 lbs. per square inch, being equal to that of a good quality of rubber. A similar plan, though not requiring any very large pressure, is due to Mr. Westinghouse, who thought of employing it four or five years ago in Philadelphia. The second occurred to the writer on reading Elihu Thomson's articles on the use of liquid air as an insulator. It is this: Since ice at only 12 below freezing has a specific resistance of over 1,000 megohms, i. e., as good as some brands of insulation, why not make the conductors hollow, lay them in a trench filled with water, pass cold brine through the pipes,

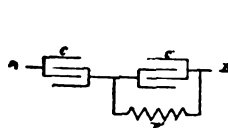


FIG. 7.

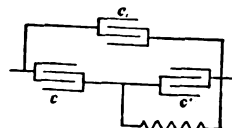


FIG. 8.

use the brine for cooling houses, making ice, etc., and let the frozen water act as the insulator. A rough calculation shows that this is commercially feasible, even neglecting all sources of profit from the furnishing of the brine (i. e., if it were used only for cooling the pipes). After making all allowance for friction of fluid, cost of power, etc., the balance comes at the right end if the line is always fully loaded.

The question is sometimes raised, whether we can ever hope to have a non-inflammable substance which shall be elastic like indiarubber. The probable cause of the elasticity of rubber is known,† and it

would seem as if there was no reason why such a substance should not be prepared. All we have to do is to coagulate one substance in the midst of another. In fact we have at present in tetrametaphosphate of sodium such a substance, elastic as rubber, transparent and tough, and when pure a good insulator. It would be an admirable material if it were not for the fact that the elasticity is due to water, and when this dries out it becomes brittle.

As regards an organic artificial rubber, I have very little doubt but that it will be made as soon as it is understood by chemists that its properties are due to structural and not chemical causes.

Armature Windings.—The present methods of using mica leave little to be desired. The writer might mention, however, one novel method he used in a case where very heavy currents were to be carried. Asbestos and silicate of soda, as is well known, form a good coating, but is however poor mechanically. The armature bars were wrapped with asbestos string and then coated with the silicate. This made when dry an extremely firm covering which could only be removed with a hammer. Though at first a bank of 100 lamps could be lit up through the insulation, after a little running it dried out to quite a high figure and the machine did good service, at one time running several hours, as I am informed on good authority, under such an overload that the brushes were red hot.

In cases where cloth is to be treated we have a very different question. There are two ways of using cloth, 1st, as a backing merely, by coating it on the surface with some substance which is supported by it, as plaster on lathing. Many substances work well in this situation, but the fact that little tubes of cellulose are very apt to stick up through the coating, as was pointed out to me by Mr. F. R. Upton many years ago, and that if moisture gets in at the edge it spreads all over, renders it not the best kind of insulation. Rubber is sometimes applied in this way to cotton tape, but though of very high resistance and insulation at first it rapidly deteriorates. In general it should be said, that where a permanent result is desired rubber should never be used unless kept in the dark and out of contact with air. If these precautions be neglected the life is very short. The other method is to saturate the whole cloth with some substance which will penetrate every crevice, but when this impregnating substance has solidified it must continue to fill these crevices and capillary tubes. For this reason no substance which is dissolved in anything else can be used. If for instance we try a varnish dissolved in alcohol it will be found that the strength of the solution in the capillary tubes is much smaller than outside, for the same reason that sea water filtered through sand becomes fresh.* Consequently, on drying, these capillary spaces are not filled up, and let water in. Therefore unless we adopt the first method and plaster the insulator on thickly and deep enough so that it does not matter whether the support insulates or not, we must use melted solids or drying oils. Unfortunately, but few solids which melt are elastic, since this elasticity is obtained by a structure which is destroyed by melting, and those solids which melt into thin liquids and remain flexible when solid do not preserve this property except within narrow limits of temperature, as can be easily tested by holding under a cold water tap and striking the specimen sharply. Soft paraffin can be used in some cases if the cellulose be well dried and thoroughly saturated. The asphalts cannot as a rule be used, as they never get sufficiently fluid on melting. There is, however, one notable exception: uintabite, or, as it is commercially called, gilsonite. This substance I found many years ago had the peculiar property that, when melted, like paraffin or oil, it will pass into the pores of cellulose or cloth. Having a very high melting point, nearly 300°, if I remember, and mixing perfectly with paraffin in all

* Popularly known as the Tesla coil, on account of his having brought it into prominence through his use of it in his lectures, though it was invented and first described by Elihu Thomson.

* *Elec. World*, Aug. 8 and 22, 1891.

† *Phil. Mag.*, Dec. 1892.

† *Molecular Physics*, Franklin Inst., Sept. 18, 1896.

* J. J. Thomson, "App. on Dyn. to Phys. and Chem.," p. 199.

proportions, it gives mixtures which are admirably adapted for induction coil work as these compounds can be made to have high melting points and to penetrate a coil thoroughly. I also some years later, in 1891, used this material in combination with linseed oil for transformers, the process at first proposed being boiling in vacuum, but it was found that even without this saturation was complete. I understand that this method is still used, though modified in form, by the company for which I first devised it. Of the drying oils, with the exception of some foreign oils, as Chinese wood oil and an African oil whose name I cannot recollect or ascertain, linseed and the drying nut oils are the best. Linseed oil has the remarkable property of expanding on drying. This enables it to fill up all pores. Its durability is evinced by the good condition of old oil paintings. The varnishes crack and go, but the oil remains. Its insulation is not injured up to very high temperatures at which shellac, rubber, etc., would be worthless. This material was used a great deal by the Edison Company in its early days, but it often broke down. The trouble was traced to the lead drier, and after many experi-

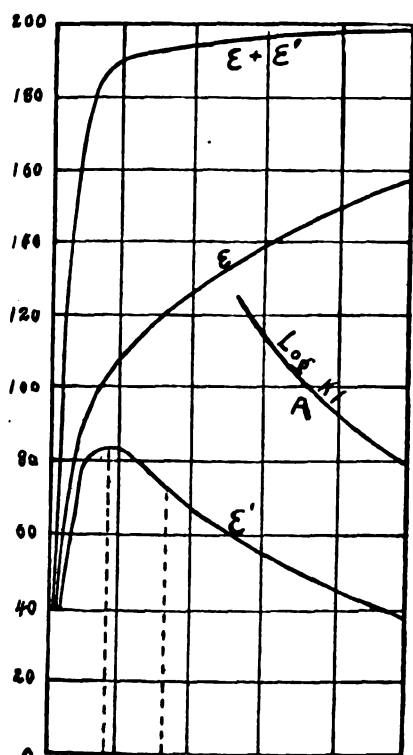


FIG. 9.

ments Mr. Marshall, who had charge of this work, finally settled upon the use of pure raw oil. This gave excellent results, and was long used but took some time to dry, and the writer finally, after many tests, found that borate of manganese drier got rid of the trouble, while, as is well known, it gives a very quick drying varnish. This was used by the United States Company in Newark on their machines with the result that in 1890, after use for a year, the foreman reported only two armatures so treated as returned for repair (they were injured by lightning) and no fields. This material was also used by the Stanley Company for transformers. Another advantage of this borated oil is that it always retains a slight stickiness, and so gives a good joint when wrapping around wires, etc. Many substances so used are not sticky and let moisture in through the joints. Where a smooth surface is required, it is readily obtained by dusting on a little talc, a method first suggested, I believe, by Mr. Edison. It can also be given a coat of Japan on the outside. Varnish gums should never be used with linseed oil, as they are brittle, and the dried oil is only just flexible enough. Consequently when the oil has dried the resultant varnish is always very brittle. A temporary elasticity is given at first by the fact that when the solvent has dried off the oil is still fluid and undried, and as the varnish gum keeps the air from getting at it

rapidly, it sometimes remains flexible for a year. Such mixtures also crack when cold.

Sample *c* is a specimen of borated oil saturated cloth which is now between eight and nine years old. It will be noted it is still fresh and flexible, and a recent dielectric strength test showed up very high, 7,000 volts, if I recollect. The pure raw oil is boiled at about 200° with $\frac{1}{2}$ per cent. of borate of manganese for several hours till it begins to be thick.

Non-inflammable materials can be made, as I have pointed out elsewhere, by taking out the hydrogen atoms of hydrocarbons and substituting chlorine. Even paraffin can be thus treated if kept warm, and first turns to a fluid and then to a solid. At one time it seemed as if this process might be valuable, but the use of enclosed conduits has done away with the greatest source of danger from fire.

I will conclude by describing a couple of devices which I have found useful in preventing insulation from being spoiled. Soldering acid, as commonly used, is a solution of chloride of zinc. If this falls on cellulose it turns it to a paste. It never evaporates and always takes up moisture from the air, and will gradually eat its way through quite a thickness of insulation. Whether it is acid or neutral makes no difference so far as its action on the insulation is concerned, though the neutral solution does not corrode the wire. Rosin has the disadvantage that it is not a fluid and is clumsy to handle. I have found that by shaking up powdered rosin in a very strong ammonia an ammonia soap is produced which works well in most cases. The ammonia dissolves the copper oxide and evaporates afterwards, leaving the powdered rosin, which is an insulator.

Apparatus can be protected from overheating by putting in the apparatus a small glass tube filled with carnauba wax. This melts near the danger point, but remains quite hard up till then, so that by imbedding a spring and contact in the wax when the apparatus gets too warm the wax gives, and the spring expanding causes a short circuit which blows the fuse.

The largeness of the subject must be my excuse for the fragmentary nature of this paper. After I had begun it I found I had made a mistake—what I should have undertaken was to write a book. I trust, however, that some of the points I have developed may prove of interest.

THE REGULATION AND PROTECTION OF THE ELECTRIC MOTOR.*

BY HARRY H. CUTLER.

Electric transmission of power is fast becoming recognized as capable of almost universal application to all kinds of machinery. Scarcely a meeting of manufacturers, trade associations or engineering societies takes place where something of a favorable nature is not said about this rapidly growing and important industry. It can be truthfully stated, however, that the public is only just beginning to recognize the adaptability of the electric motor, and that an enormous demand awaits it in the near future.

The introduction of the electric motor into general use has not been as rapid as is generally supposed. Seventeen years ago the writer took for the subject of his graduation thesis "The Losses in the Transmission of Power by Means of Shafting and Belts." The results obtained were exceedingly interesting, and it might not be out of place here to mention some of them.

It was found that five-sixths of the power consumed by the engine was absorbed in the belts and shafting of the machine shop, and the very best result obtained with every machine in the shop running full, something which never occurs in practice, was an efficiency of about 30 per cent. The following deductions were then made from these results.

Attention is called to the saving which would ensue if power could be produced at each machine by means of a miniature steam engine or electrical machine, as illustrated by the low efficiency obtained in these experiments, the power to be transmitted by pipes in the form of superheated steam, or by wires conveying a current of electricity, instead of the present system of cumbersome and expensive shafts and pulleys.

It has been known, then, for at least 17 years, and undoubtedly a great deal longer, that transmitting power by means of belts and shafting was expensive and uneconomical, and a remedy was pointed out at that time which is just being recognized today as good practice, and yet it is safe to say that nine-tenths of our mills and factories are still wasting unnecessarily enormous amounts of money by clinging to this antiquated practice of belt transmission. This is what is meant by the assertion that an enormous demand is in store for the electric motor.

We now see motors not only fast displacing belts and shafting, but also operating many kinds of machine tools, traveling cranes, hoists and elevators, pumps, ventilating fans, printing presses, mining machinery, dredges, street cars, railways, vessels, air ships, implements of war, telescopes and scientific apparatus, and in fact almost every conceivable application of power.

Now there is one peculiar feature which comes up with each and every motor that is installed, namely, that a connecting link between the motor and what it is to drive must be provided which shall be adapted to the peculiar kind of work to be performed. This connecting link is the rheostat or controller, and the rapidly growing demand for these devices has given rise to what could almost be called the profession of rheostat engineering. By means of the rheostat or controller the motor is started and stopped, its direction of rotation is determined upon, and the speed at which it shall rotate is varied at will.

The same motor which drives a pump would drive a fan, a printing press, or a line of shafting as well, but the proper type of rheostat to use for these various applications of power would be vastly different in each case. Generally speaking there are but three kinds of direct-current motors, the series, shunt and compound wound, and the best suited of these three types of motors is selected to do the work. The types of rheostats for controlling these motors, however, are so numerous that only a few can be mentioned in this paper.

By far the largest number of stationary motors in use to-day are direct-current, plain shunt-wound, non-reversing and run at a constant speed. These motors are usually provided with motor-starting rheostats, whose resistance is in circuit only during the few seconds consumed in starting the motor. Simple as these rheostats are, great care should be taken in selecting the size and style best suited for the work.

A motor that is started and stopped but two or three times a day can be satisfactorily handled with a starting rheostat that would frequently be almost useless for starting and stopping a motor two or three times a minute. A rheostat arranged to start a motor under full load to the best advantage will not start a motor equally as well at 100 per cent. overload. A rheostat satisfactory to the Fire Underwriters of Chicago is not necessarily adaptable to the New York authorities, and would be looked upon as unnecessary extravagance by the country trade. It is important then even in the very simplest cases that the character of the work should influence the selection of the proper starter or rheostat, and when it comes to applying a motor to almost any other use than that of driving belts and shafting, this question becomes of still greater importance. Most stationary motors are operated at constant speed, but consumers of power are finding out that the speed of a motor can easily be regulated at will, and are calling for appliances which will accomplish this.

I can almost say that there is but one way by which the speed of a motor, of direct current, can be

* Paper read before the Chicago Electrical Association, April 1, 1898.

changed, and that is by changing the voltage across some of its parts or windings. There are a great many ways to accomplish this. The simplest, but unfortunately the most unsatisfactory, way of reducing the speed of the motor is to reduce the voltage across the armature by inserting external resistance in series with it. This method is uneconomical on account of the current absorbed by the rheostat, and also destroys the self-regulating property of the motor. The speed of a shunt-wound motor varies approximately with the voltage across the armature or brushes; with external resistance in series with the armature, the speed will vary to a much greater extent for the following reasons: When the load on the motor is increased the current (C) must increase. This increase of current can only occur by a decrease in speed which lowers the counter-electromotive force of the armature, thereby permitting more current to flow. But the current of course has also increased in the rheostat, while the resistance (R) of the rheostat has, unlike the armature resistance, remained the same, hence since

$$C = \frac{E}{R} \text{ we see that the electromotive force (E)}$$

across the rheostat must be increased in some way in order to allow more current to flow. This increase can be derived by slowing down the armature and reducing its counter-electromotive force. A very slight increase in the load when external resistance is in series with the armature will then often actually stop the motor entirely. Such cases as this have been so frequently causes of complaint from customers that it would appear that the effect of external resistance in series with the armature is not at all well understood by either users, owners or salesmen of electric motors in general. The prevailing opinion seems to be that a speed regulator of the above type can be set so that the motor will run at a certain speed independent of the load. In proof of this assertion many orders can be shown from some of the largest manufacturers of motors in the country, calling for a certain number of steps in the regulator to give a corresponding number of fixed speeds for the motor.

Another method of changing the voltage across the armature is to operate the motor on a three-wire system, connecting the armature across the outside wires for high speed and between the neutral and one of the outside wires for low speed. This method wastes no current and causes the motor to assume a definite speed independent of the load.

Still another method, which is ideal so far as the motor regulation is concerned, is to connect the armature across a variable number of storage batteries, thus obtaining any desirable speed over wide ranges. Another method consists in so winding the armature that the coils may be changed from parallel to series, which can be accomplished in several ways.

Altering the voltage across the field of a motor also affects its speed, but in exactly the opposite way from that caused by changing the voltage across the armature. To increase the speed of a motor we can decrease the strength of its field, and there are many ways of doing this. The simplest and one of the best is the insertion of external resistance into the shunt field circuit. This method is not only very simple and inexpensive, but, unlike the armature regulation through resistance, it wastes comparatively nothing in heat and allows the motor to assume the desired speed and maintain that speed independent of the load.

Motors are to be had of nearly all the large builders which will operate satisfactorily with a field variation of 50 per cent. in actual ampere turns. The same result is frequently obtained by using a compound wound motor, winding the series fields in separate sections and cutting out these sections one by one by means of a special switch. At least one manufacturer goes so far as to use so many of these field sections that their resistance is sufficient to

prevent more than the proper amount of current from flowing on closing the circuit without using any external resistance whatever. The series windings are then cut out one by one as the armature revolves. A very powerful starting torque and a wide range of speed is thus obtained. This method however will not regulate the speed independent of the load, as the field strength cannot be kept constant. It is applicable therefore chiefly to cases where an attendant is constantly on hand, as in the case of elevators, cranes and hoists.

One more method of varying the field strength consists in throwing the windings of the field cores into series connection for high speed and series multiple for slow speed.

Motors are sometimes regulated by means of using a separate generator for each motor and varying the voltage of the generator by means of its field rheostat. This method is known as the Leonard system and gives perfect regulation over a wide range.

We have now before us a long list of methods from which to choose the system of regulation best adapted for the work at hand. One of the simplest and best is that frequently used for regulating motors driving fans and blowers, by means of so-called compound speed regulators. No large office or school building is now considered up to date which is not provided with artificial ventilation that can be regulated at will.

The motors which drive the fans are so belted or geared to the fan that when the fan is operating at the average speed desired no external resistance of any kind is in circuit. To reduce the speed, the rheostat lever is moved to the left and resistance is cut into the armature circuit, and to increase the speed the lever is moved to the right and external resistance cut into the shunt field circuit.

To select the proper sized motor and to determine upon the proper speed to run the fan, requires an accurate knowledge of and experience with fans, air ducts and the laws of moving air. This is another subject which has not been reduced to a science by fan builders. Some builders always use a series wound motor for driving fans, and others have adopted the shunt wound motor. When it is not necessary to vary the speed of a fan, the series motor is probably preferable as being simpler, but for driving large fans where speed regulation is always desirable the use of a plain shunt wound motor and a compound wound regulator appears to be the best practice.

In proportioning the resistance for a fan regulating rheostat it must be borne in mind that the power required varies directly as the third power of the speed, and not directly as the speed as in driving shafting and machine tools. A regulating rheostat for a fan is therefore designed on entirely different lines—even the contacts and mechanism are different, because a fan is never started and stopped at frequent intervals during the day, and a cheap button front will do the work satisfactorily.

Diametrically opposed to the fan regulator is the electric elevator controller. This work calls for continually starting and stopping several times a minute all day long; heavy renewable contacts are absolutely necessary, as well as a special type of motor, and problems of entirely different character are to be met with. It is not practicable to build an elevator controller all ready to fasten to the wall with a string latched to it for the operator to pull. Such devices are on the market in abundance, but should be regarded as a source of great danger.

An elevator controller to be safe should be embodied into and form a distinct part of the elevator mechanism, and should be attached to the elevator mechanism by the elevator manufacturer, and not by the motor manufacturer or his selling agents.

There are a great many good methods of operating electrical elevators on the market. Among those methods in most common use is the system which uses a compound wound motor and compound regulation. The motor is started through external re-

sistance which can consist of a rheostat or the windings of the series coils themselves. This resistance is then cut out in several steps under control of some kind of a governor; the series field coils are then cut out, and finally the shunt field is weakened by the insertion of external resistance. The operation of electric elevators brings up the problem of—how to reverse an electric motor. To accomplish this it is only necessary to change the relative direction of the current in either field or armature circuits. The moment we do this however new troubles arise; means must be provided to prevent the possibility of reversing the direction of the current without either first stopping the motor or at least inserting external resistance into the armature circuit. Means must be provided to prevent excessive sparking or burning at the switches as well as undue strain on the insulation of the motor.

In order to reverse a motor the field and armature have to be controlled by independent circuits. Whenever a circuit is suddenly opened that contains coils of wire wrapped around a mass of iron, a secondary or induced current is formed, which has a potential many times higher than that of the primary current. This current not only burns the switches, but is sure to puncture the insulation of the motor, sooner or later, unless means are taken to prevent it. Many designs of elevator controllers and rheostats on the market try to overcome sparking by opening the circuit with a snap switch, but electricity cannot be fooled in any such a simple mechanical manner as this. The flash and consequent strain on the insulation of the motor is only increased the more, and all that is gained is that the switch does not burn up so quick. This is no dream but it is an actual fact that the market is flooded with rat-trap devices which claim to eliminate sparking by means of snap-switches. A snap-switch is well enough for use in a lighting circuit, but when used in connection with a reversible motor it is a constant menace to the safety of its insulation. Everyone knows, who has handled a motor, that if the double-pole knife switch is pulled, even when the motor is heavily loaded, a destructive spark is never obtained. The reason for this is that the armature and shunt fields are not separated, and consequently no induced current is formed in either and no strain whatever on the insulation occurs. The motor becomes a generator, energizing its own field and gradually slows down and loses its magnetism. A similar condition of affairs can be obtained on a reversible motor. Before opening either the field or armature circuits, both sides of the line should be opened simultaneously, which of course will cause no sparking, as just pointed out. External resistance should then be inserted into the armature circuit, and finally the armature connections should be reversed, leaving the shunt field circuit at all times closed upon the armature. No destructive sparking or strain upon the insulation of the motor will then occur—the supply of current is absolutely cut off from the motor, and the short circuiting of the armature through the resistance of the rheostat occurring while the field is at full strength acts as a dynamic brake and assists to stop the motor. This method of braking a motor is easily worked out so that the ordinary mechanical brake never sets until the motor has stopped or nearly so.

When an elevator is coming down with a heavy load the motor has no work to do and consequently has a tendency to run away, being driven by the weight of the elevator. If the motor is plain shunt wound and its field kept at constant strength, the load on the elevator will tend to drive the motor so much above its normal speed that it becomes a generator and returns current to the line. The speed of the motor will then increase until a potential is reached sufficiently above that of the line to consume the power derived from the effective weight of the elevator. The motor will continue to revolve at this speed, which in case of the plain shunt wound motor would not be a dangerous speed. But plain

shunt motors are now seldom used for elevators; almost all builders of elevators use compound wound motors, or at least shunt motors whose field is weakened after starting.

Motors which bring an elevator to full speed by weakening the field would run much faster when driven by a heavy load on the elevator, and it becomes necessary for the attendant to check the speed by moving the lever back and thus strengthening the field. Should the attendant move the lever so far back that external resistance is inserted into the armature circuit, the speed of the elevator would be increased instead of decreased as at first might be supposed, and a dangerous speed would result. This curious condition of affairs is due to the fact that with external resistance in the circuit with the armature when the motor is running as a generator it will have to run enough faster to produce sufficient potential at the brushes to overcome the external resistance and deliver to the line the increased potential necessary to check the speed of the motor.

The application of the electric motor to the printing press is another problem full of interesting points which time will not permit of taking up, and we will pass on to the second part of the subject.

THE PROTECTION OF A MOTOR.

Motors burn out when overloaded because they get hot. They frequently burn out also because currents of high potential are allowed to occur which puncture their insulation. Excessive currents scar the commutators and foreign materials produce circuits which lead to damage.

To properly protect a motor from damage by the electric current, these four effects must certainly be guarded against.

Motors can only become dangerously hot by abnormal currents being allowed to flow for an appreciable length of time. A current of double or treble that of the continuous safe carrying capacity of the motor will not do the slightest harm unless allowed to flow long enough to overheat the motor. When such abnormal currents last only a few seconds it is neither necessary nor desirable for the protecting device to operate, and a properly designed protector should not operate unless the temporary abnormal currents exceed this amount, or last long enough to overheat the motor. Since it is the heating effect of the current which causes an overloaded motor to burn out, the most natural protection would be a device that operates through the influence of this same heating effect of the current. The well-known fuse was, therefore, recommended for this work, and the electrical trade accepted it without question. As motors came into more general use it began slowly to dawn upon the electrical profession that they were being misled in their implicit faith in the fusible cut-outs offered by the trade. Too many motors supposed to be protected by fuses burn out, and experiments show that the ordinary commercial fuse will blow at almost any amount of current or not at all, just as it happens to feel at the time.

The manufacturers then attempted to more thoroughly standardize their fuses, and even made a faint attempt to standardize the cut-outs for holding them.

College professors took up the subject and made careful tests, and wrote able articles about standardizing fuses. The conclusion which came was, that the chief trouble lay in the fact that the fuses in common use were so short that the terminals and blocks to which they were fastened caused their blowing point to vary by conducting off heat which would otherwise have caused the fuse to blow. This, they said, could be entirely overcome by using fuses 6 or 8 inches long, and then we would have reliable fuses. Not enough significance appears to have been given to the cooling effect of the ever-varying drafts of air to which the ordinary commercial fuse is exposed, and, therefore, to expect any exposed fuse, no matter how long, to blow at a certain predetermined amount of current, appears to

the writer to be little short of an absurdity. People naturally became disgusted and looked around for something better with which to protect their motors. Into this breach the magnetic circuit breaker bobbed up serenely with its claim for perfection.

The magnetic circuit breaker recognizes nothing but amperes, and takes no account of whether the motor is hot or cold. Now amperes do not of themselves burn out our motors, it is the heating effect of these amperes, caused entirely by the length of time which they are allowed to flow. Volts, on the contrary, care nothing about time, so to speak; when the voltage gets high enough the current jumps, and the damage is done instantly, not through ordinary heat, but by the irresistible heat of the electric arc, which volatilizes the wires themselves. It should be noticed, however, that excessive abnormal currents cause instant damage to the commutator of a motor, if not to the armature itself, and should be cut down as quickly as possible. This latter office the ordinary commercial circuit breaker will generally perform satisfactorily. It becomes a nuisance, however, by opening the circuit and interrupting the service at every little temporary abnormal fluctuation of current, which current would not do the slightest harm, and calls for no protection. What is needed then for properly protecting a motor is—first, a device that will not allow extremely abnormal currents to flow into the motor at all; second, one that will allow slightly abnormal currents to flow through the motor, until the motor begins to approach a dangerous temperature, and third, the device should check an excessive flow of current so that no undue strain will be put upon the insulation of the motor. No such ideal protection exists to day to my knowledge.

The first requirement would be very difficult to meet, and the best that has been done so far is to stop the excessive flow of current through the motor as quickly as possible. The other two requirements are more easily complied with. To protect a motor from heat, it is evident that the heating effect of the current should be utilized in the protective device. This is accomplished in at least two devices now on the market, namely, the inclosed fuse and a peculiar make of circuit breaker designed by the writer. Both of these devices are shown by samples on the table. The inclosed fuse shown is of the D. & W. make, and the fiber case has been removed in order to show its construction more clearly. The distinguishing feature of this fuse is the inclosed air chamber around the fuse proper, consisting of a gelatine capsule, similar to those used by apothecaries for filling with quinine and other medicines.

The fuse proper is very short, and is contained entirely within the capsule; copper wire leads are connected to the fuse, and lead out to the terminal caps through closely packed sand or plaster of paris. The capsule provides a definite amount of air within which the explosion takes place, thus greatly increasing the accuracy of blowing at predetermined currents. The force of the explosion is taken up by the layers of sand on each end, and as there is no air and but little metal to feed the arc, it immediately goes out. These fuses are surprisingly accurate, and being absolutely sparkless would certainly appear to be an ideal protection both for the motor and as against fire. They are ahead of the times however, and the vast majority of those who operate motors still cling to the old bare fuse, working in the open air, for the protection of their motors.

Circuit breakers are being introduced very rapidly as a protection for motors, and I have one here which is constructed on a somewhat different principle from anything on the market.

The action of this circuit breaker depends upon the combined magnetic and heating effect of the current. Its mechanical construction is very similar to the usual type, the chief difference being that the magnet or solenoid used to release the trip or catch carries only a portion of the current passing through

the breaker. The rest of the current is shunted around the active coil of the circuit breaker, just as Edward Weston does in his well-known station ammeters. The shunt used in this circuit breaker, however, is composed of material whose resistance increases very rapidly as it becomes heated. The action of this circuit breaker is very simple. On starting up a motor under load, both motor and circuit breaker are cold, therefore the resistance of the shunt on the circuit breaker is at its lowest point, and it carries then the largest part of the current flowing through the breaker; as this current continues to flow the shunt heats up, its resistance increases, and more current passes through the magnet or active coil, which will finally act should the abnormal current last long enough to become dangerous. It is also evident that an extremely abnormal current, or a short circuit, would not wait for the heating effect of the current, but would cause the breaker to open instantly.

In practice these breakers are generally so proportioned as to allow a current of 50 per cent. greater to flow for a second than would finally open the circuit if allowed to flow for a minute or two. Any current over 60 per cent. greater than the continuous current which would finally open the circuit breaker will do so instantly.

A modification of the circuit breaker is the so-called overload attachment to motor starting boxes provided with the magnetic release. They are frequently spoken of as an under and over load motor starter. All the various makes of this type of motor starter use an electro-magnet for retaining a switch or rheostat lever in closed circuit position. This retaining magnet is wound so as to connect in series with the shunt field, in series with the armature across the lines, or in series with external resistance across the lines. The overload magnet is invariably connected in series with the armature, and carries usually the entire current supplied by the motor. When the current becomes excessive it attracts its armature and demagnetizes the retaining magnet by short circuiting, or opening the circuit of the windings of the retaining magnet. There are also several other ways of demagnetizing the retaining magnet.

A surprising degree of accuracy and reliability can be obtained in this way of protecting a motor from overloads. The system has, however, one chronic fault, which appears to have been entirely overlooked, and that is, that no device constructed on the above principle can possibly act quickly enough to protect a motor against extremely abnormal currents, short circuits or lightning, notwithstanding all circulars and advertisements to the contrary. It takes time to demagnetize a magnet, no matter whether it is short circuited or open circuited, and this time is fatal on short circuits, and the motor will not be protected. We must then choose some combination of the various methods just described of protecting a motor. We have here on the table such a combination, which would appear to afford adequate protection for the least money. This device utilizes inclosed non-arcing fuses, the magnetic release, overload magnet, and double-pole knife switch. The magnetic release affords ample protection from liability to damage from interrupted current. The overload magnet takes care of all ordinary overloads, and also performs the office of an ammeter which will indicate the approximate load on the motor at any time. The fuses are selected so as to blow on 100 per cent. overloads up to short circuits. The overload magnet can also be provided with the time limit device described above in connection with circuit breakers. This method of protecting a motor is laid before you for your consideration, and I desire to place myself on record as believing that with such a device on the market for protecting a stationary motor, there are very few places or conditions where the ordinary magnet circuit breaker will afford equal protection and satisfaction, or be provided at as small a first cost,

LEGAL NOTES.

Argument in the suit of the Sprague Electric Railway Motor Company of New York vs. the Steel Motor Company of Johnstown, Pa., was heard in the U. S. District Court at Pittsburgh, Pa., on the 6th inst. The suit is for an infringement of a motor for electric railways. Judge Bullinton reserved his decision.

The St. Paul Globe of the 1st inst., in its court report, says: "A decision was handed down yesterday by Judge Otis in the case of Joseph M. Hill vs. the Carpenter Electric Heating Manufacturing Company and the American Heating Company. Judgment is given for plaintiff against each of the defendants in the sum of \$1,344.59. The sheriff is instructed that failing to collect the judgment from the Carpenter company he is to levy on the property of the American company, which is held to be the holder of all the property of the Carpenter company."

The full bench of the Massachusetts Supreme Court on the 1st inst. overruled the defendant's exceptions in the case of William Thompson vs. the Lowell, Lawrence & Haverhill Street Railway Company. As a result the defendant must pay the plaintiff the verdict of \$5,045, which he recovered in the Superior Court. The suit was brought for damages for the loss of an eye consequent upon an exhibition of negligent marksmanship given by a "man born with-out hands" in a grove owned and maintained as a pleasure resort by the defendant. The plaintiff was a spectator, having been brought there on one of the defendant's cars, induced by an advertisement on its cars. While witnessing a stage performance the plaintiff's eye was injured by the fragment of a bullet fired by one of the performers at a playing card. The exhibition was given by a manager who was under contract with the defendant, and who furnished the handless marksman as well as the other entertainers. A butt was provided to receive the bullets, and all the appliances were furnished by the manager. The Supreme Court says it is apparent that the accident happened from a cause which might have been prevented and that ought to have been foreseen or guarded against by somebody; that the general arrangements for an exhibition of this nature should be such that fragments which might fly from the impact of the bullets could not reach the spectators; that due care was not taken in the arrangement of the stage with reference to possible accidents of this kind, and that the defendant company failed in its duty in this respect.

It is stated in a dispatch to the Chicago Inter-Ocean from Bloomington, Ill., that Judge Myers in the McLean County Circuit Court made a ruling on the 31st ult. in the Bloomington City Railway litigation sustaining the findings of the master in chancery. The gist of the decision is that the company's property must be sold in a lump and not by sections, as it was acquired by the present owners. The litigation involves a plant which is bonded for nearly \$500,000 and has been in operation for more than a year. If no plans mature by May 1 to raise money to fund the bonds, the road will go to foreclosure and sale and the proceeds be distributed according to the mastery in chancery's findings. Incidentally the ruling of Judge Myers provides for the payment of attorneys' fees aggregating nearly \$25,000. The Bloomington City Railway plant includes thirteen miles of track in Bloomington and Normal. Ex-United States Senator J. J. Patterson of Pennsylvania is at the head of the syndicate which controls the property.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Alexandria, Va.—It is understood that the Southern Railway Company contemplates adopting electricity to operate its line between Washington and Herndon.

Boulder, Col.—An electric street railway company is being organized by five of the heaviest capitalists in the city. The company will build about four miles of street railway, running from the depot to the Colorado Sanitarium in the northern part of the city, with a branch to the State University, and the new Texas Chautauqua grounds. The council will be asked to grant the franchise at its next meeting.

Chicago.—The South Side Elevated (Alley "L") people expect to have a considerable number of their trains operated by electricity by April 15.

Cleveland, O.—A company has been formed with a capital of \$1,200,000 to build an electric railway from

Cleveland through Geauga and the south part of Ashtabula County. The road will touch Punderson lake, which Cleveland capitalists have recently purchased, and thence run east to Andover, through Burton and Orwell. The entire route will be a private right of way for the purpose of permitting the company to transport freight over its lines as well as passengers. The route has been surveyed to Burton and the work of construction will probably begin soon.

Cumberland, Md.—West Virginia, Pennsylvania and Maryland capitalists are planning to build an electric railway from Cumberland to Petersburg, W. Va., a distance of sixty miles. The road would run through three counties and would open up a rich and prosperous section of West Virginia, and pierce a country the greater part of which is from fifteen to forty miles from a railroad. The freight traffic, now carried on along the route of the proposed road by wagons and stage, is enormous, and it is thought would be greatly increased should the railway be built.

Danilson, Conn.—The People's Tramway Company have transferred their charter to Sanderson & Porter of New York City and Robert L. Warner of Boston. Engineers will be put at work at once on the road between Danielson and Putnam, and if nothing serious happens the road will be in operation by the 1st of August.

Elizabeth, N. J.—The board of freeholders of Union County will hold a special meeting on Thursday of the present week to consider the question of selling to the highest bidder the franchise to build a trolley line on Westfield avenue from Elizabeth to Plainfield.

Frederick, Md.—The directors of the Myersville & Catoctin Valley Electric Railway have ordered their engineers to begin work at once. The proposed line is five and a half miles in length, and connects Myersville with the Frederick and Middletown electric line.

Freehold, N. J.—The Monmouth County board of freeholders has granted a franchise to the Monmouth Traction Company for the use of the county road from Freehold to Matawan for a single track trolley road. The franchise covers but a part of the traction company's intended system. It is the intention of the company to build a trolley road from Keyport through Matawan, Freehold, Allentown, Bortown and Burlington to either Beverly or Rivington, respectively fifteen and eight miles up the Delaware river from Philadelphia, and connect the terminals with New York and Philadelphia by lines of fast steamboats, thus making a cross State trolley road.

Kingston, Jam.—The construction work on the tramway here was begun on the 6th inst. A number of American and Canadian capitalists are interested in the road.

Lewiston, Me.—The stockholders of the Lewiston & Auburn Horse Railroad Company have closed a deal by which their road is transferred to the Brunswick Electric Railroad Company for the purpose of securing consolidation of the lines of both companies and forming a new company to be known as the Lewiston, Brunswick & Bath Electric Road. The new company will put two powerful generators upon the Cabot Company's wheels at Brunswick and distribute power from that station to all its lines.

Madisonville, O.—The completion of the electric railroad was celebrated on the night of the 2d inst. with fireworks, illuminations, bonfires and cannon salutes. The houses all along the line were decorated with flags and bunting, the village band played its liveliest airs and there was great rejoicing. The line is ten miles long.

New Haven, Conn.—The New Haven Railroad Company will equip with the trolley its Stamford and New Canaan branch, which is about eight miles long.

New Brunswick, N. J.—The New York & Philadelphia Traction Company and the Brunswick Traction Company, heretofore bitter rivals, joined hands at a banquet in this city lately in which about 200 officials of Burlington county and others took part. Secretary Radel, in announcing the union of the two companies, said that they were now controlled by Gottfried Krueger of Newark; Andrew Radel, of Bridgeport, Conn.; J. Blair MacAfee, of Bound Brook, and himself. They are now seeking for franchises in Burlington county, and it was to show the Burlington people what kind of a road they could give them that the officials were brought to this city. It is hoped to unite New Brunswick with Camden by trolley, and the route to be taken is by way of Franklin Park, Princeton, Trenton, Bordentown and Burlington.

Ottumwa, Ia.—The Ottumwa Electric Railway is advertised by W. C. Howell, Master in Chancery, to be sold at the court house in Ottumwa on the 28th inst.

Portsmouth, N. H.—Negotiations have been concluded for transferring the charter and stock of the Portsmouth Horse Railroad Company to the Portsmouth & Dover Railroad Company, a branch of the Boston & Maine Railroad. The Portsmouth & Dover will now proceed to build the projected electric line in Portsmouth, the other company retiring from the field. The officers of the new company are: President and managing director, Lucius Tuttle; treasurer, Herbert E. Fisher; clerk, Frank S. Streeter.

Shamokin, Pa.—The Shamokin Street Railway has been sold to Judge Savidge and Congressman Kulp, who will make many improvements and put it in operation at an early date.

Syracuse, N. Y.—William K. Niver has made application to the council for a franchise for an electric railway from the center of the city to the western city line,

Whitehall, N. Y.—A conference of those interested in the proposed electric railway to connect Whitehall and Granville was held here a few days ago, and it is understood that the construction of the road was determined upon. The company when organized will have a capital stock of \$300,000, and Hon. H. G. Burleigh of Whitehall will probably be the president.

LIGHTING PLANTS.

Boston, Mass.—The Committee on State House has requested Engineer Legg and Electrician Bailey to suggest a detailed method of electrically lighting the dome of the State House.

Concord, Mass.—At the annual town meeting on the 4th inst., it was voted to construct a municipal electric lighting plant to cost \$35,000.

Covington, Ga.—The Electric Supply & Construction Company of Savannah has signed a contract for an electric light plant for Covington. An exclusive franchise for 20 years is granted.

Des Moines, Ia.—Mayor MacVicar has received a letter from Eugene Holcomb, member of the McCaskey-Holcomb Company of Springfield, Ill., in which the writer says that Des Moines can rest assured that if the contract with this company is abided by and the work started, Des Moines will have the "best and most perfect plant for municipal lighting in existence," and that its erection will "mark a new epoch in superiority of design and economy of operation."

Elmira, N. Y.—The council has appropriated \$300 to defray the expense of making investigations and preparing plans and estimates for an electric lighting plant for the city.

Fortress Monroe, Va.—The big electric searchlight has been placed in position in the fort and is now ready for operation. It is one of the strongest in the country.

Henning, Minn.—At a mass meeting held here recently to consider the advisability of putting in an electric light plant, a committee of six was appointed to make investigations as to the expense, etc.

Huntsville, Ala.—C. F. Bost, contractor for the erection of the new electric plant here, has begun laying the foundation for the power house, which will be equipped with the most modern machinery.

Huron, O.—At the election held here on the 5th inst. the question of electric lights was carried almost unanimously, the vote being 301 for and 44 against.

Lyons, Mich.—The proposition to bond the village in \$3,000 to establish an electric light plant was carried at the recent election.

Macon, Ga.—It is rumored that another electric light plant will be erected here by a company whose organization is nearly completed.

Martinez, Cal.—At the request of C. P. Baird, a franchise for right of way and permission to erect poles and wires in Martinez for transmitting electric power for lighting and other purposes has been advertised for sale to the highest bidder. Bids will be received by the town clerk up to the 18th inst.

Miami, Fla.—There is a growing movement here in favor of putting in an electric lighting system.

Springville, Ia.—At the recent election the proposition for electric lights carried by a vote of 56 to 46.

Toledo, O.—Plans have been completed and some of the machinery purchased for lighting the local docks. Forty-four arc lights are to be distributed along the docks and throughout the yards of the Pennsylvania and Hocking Valley Railroads.

Valley Junction, Ia.—The new council is expected to carry out the wishes of the people as expressed by vote a year ago and secure electric lights for the town.

Ventura, Cal.—Lincoln Nissley has been selected by the town board to draw up plans and specifications for an electric light plant.

MANUFACTURING, ETC.

Bridgeton, N. J.—Inventors are experimenting at the Cohansy Glass Company's plant here in the manufacture of glass conduits for electric wires. The inventors claim that conduits made of glass are cheaper and better adapted for the purpose than metal or porcelain.

TRANSMISSION PLANTS.

Knoxville, Tenn.—An ordinance has passed the council granting the Knoxville Water & Electric Power Company franchises over the streets and alleys of this city. This is the company which proposes to generate electricity by damming the Holston river.

Los Angeles, Cal.—As a result of the investigations of J. W. Eddy in the Randsburg district among miners and business men, the Kern-Rand Company has been incorporated under the laws of Arizona, for the purpose of introducing electric power for milling, hoisting, lighting and domestic purposes at Randsburg and neighboring mining camps. The electricity will be generated by water power located on the south fork of the Kern river, where the water leaves the canyon and enters the valley, a distance of thirty-eight miles from Randsburg. At this point the Kern-Rand Company will have 80 cubic feet of water per second at its lowest stage, with a fall of 200 feet, insuring them an 1,800 horse-power. This can be increased to a consider-

ble extent if circumstances demand it. The incorporators of the Kern-Rand Company, all of whom are well known Los Angeles men, are as follows: General A. A. McDonnell, L. W. Godin, M. W. Stewart, William F. Rosbyshell, R. J. Waters and J. W. Eddy. The board of supervisors has granted a franchise to the Azusa Electric Lighting & Power Company to maintain and operate lines for the transmission of electricity over the public streets of Azusa and up to the mouth of the San Gabriel canyon.

New Brighton, Pa.—The Rochester Electric Light Company and the Beaver Valley Electric Light & Power Company have consolidated with the Beaver River Power Company, whose new plant will be completed as soon as possible. All the towns of Beaver Valley will be furnished with lights by transmission lines from the two plants of the company. It is expected that several manufacturing plants will be established at Fallston because of its proximity to the Beaver River Company's works, which will be able to furnish all the power required.

Tacoma, Wash.—Charles H. Baker, president of the Snoqualmie Falls Power Company, who will reside in Tacoma, is pushing the construction work of the company at the falls. Most of the machinery for sinking the shaft through the rock and for drifting the tunnel at the base of the falls is already on the ground, and as soon as it can be put in place work will go forward very rapidly. The shaft, which will be 15 feet square, will be sunk 250 feet through the rock to connect with a tunnel about half as large which will discharge the water from the falls after it has been used to create power. The power house will be excavated at the bottom of the tunnel and will be 50 feet wide and 200 feet long. It is the only power house in the world 250 feet below the surface of the ground, and will be cut out of the solid rock. The minimum capacity of the falls is 30,000 horse power, but only 8,000 horse power will be developed at this time. It is estimated that the demands of Tacoma and Seattle are now from five to seven thousand horse power and the company will develop only sufficient power to supply this demand.

COMPANY MATTERS.

Norfolk, Va.—The consolidation of the City Gas Company and the Electric Company of Virginia, the two companies which control the lighting business in Norfolk, was effected on the 1st inst. A new company has been organized, to be known as the Virginia Electric Company, with a maximum capital of \$500,000. An up-to-date equipment of electrical apparatus will be purchased and everything done to make the electric light service as fine as possible. The officers of the company are: President, Peter Wright of Newark; vice-president, W. W. Chamberlaine, Norfolk; secretary, J. W. Wilcox, Norfolk; treasurer, George Chamberlaine, Norfolk; directors: Peter Wright, W. W. Chamberlaine, W. W. Guillauden, W. W. Randolph and William H. White.

Shenandoah, Pa.—The Westinghouse Electric & Manufacturing Company filed a bill here on the 5th inst., praying that the Equitable Trust Company of Philadelphia, as trustee, be required to take possession of and operate the Lakeside Electric Railway and apply the net income to the payment of the unpaid interest on \$14,500 worth of bonds issued by the railway company and held by the plaintiff. The appointment of a receiver is also asked for. The Lakeside Electric Railway is operated between Shenandoah and Mahanoy City.

PERSONAL AND MISCELLANEA.

In case of war the X rays will be of the greatest service to surgeons in locating a bullet or splinter in a man's body, a fracture of a bone, or other serious injury. Many a limb and life may be saved by their use.

The electrician of the Capitol at Washington, Mr. Gleim, has received notification from an official source that his services will be required to take charge of the installation of an electrical system to be used in the submarine defenses of the Potomac River. A board is to be formed of electrical experts to act in conjunction with the military authorities, who will plant the mines, and the electricians will connect them with the shore batteries.

Capt. Eugene Griffin, First Vice-President of the General Electric Company, has undertaken to organize an auxiliary corps of electrical engineers to serve either in the army or navy in case of war. Dr. Louis Duncan of Baltimore has formulated plans for a similar organization to be known as the Volunteer Electrical Corps. Enough electricians have offered their services during the last few weeks to wire the whole island of Cuba so effectively that not a Spaniard could escape. All our electricians are brimful of patriotism. Even Frank W. Hawley, the canal electrician, whose insolvency was recently made public in court proceedings, has offered to the Government a regiment of 1,000 men skilled in handling electrical appliances, who will serve without pay, Mr. Hawley himself offering his services free.

Louis Enricht and Paul Hirsch, the promoters of the Canon City & Cripple Creek Electric Railroad, who were arrested and imprisoned at Denver, Col., on the 22d ult., on a charge of conspiracy to obtain money under false pretenses, were released a few days afterward under bonds for \$20,000 furnished by Dr. C. L. Perrin and A. R. Gumaer of Florence, Col. Dr. Perrin became interested in their case, says the Denver "Post," and employed two private detectives, who reported to him that Hirsch and Enricht were unjustly incarcerated.

H. A. Butters of Johannesburg and San Francisco, a member of the syndicate who purchased the Mexican

District Railway system, is in Mexico City arranging for the electrical equipment of the car lines in that city. The first line to be equipped is the one between Guadalupe and San Angel, twenty six miles in length. The system used will be the trolley. It is the present intention of the company to build a great central power station where the electricity will be generated and distributed to all the lines. Steam will be used in generating the electricity, but in the future it is found practicable to use water power in any way, the company will adopt that manner of generation. The company has already appropriated \$1,250,000 for the equipment of the first section of the road. It is expected that before all the lines in the city are equipped the total construction expenses will be somewhere in the neighborhood of \$6,000,000. A. E. Worswick is the resident engineer of the company and is getting the plans in shape. The company is composed of prominent capitalists in London. They own tramways in South Africa, Portugal and Switzerland.

The only way Mrs. Marilla L. Wood could make good a judgment secured against the Henderson Street Railway Company of Henderson, Ky., was to buy the road. This she did, rolling stock, sheds, motors, real estate, machinery, rails and every other appurtenance, for the sum of \$1,639.39. Mrs. Wood is a resident of Henderson. During the winter she was bruised and otherwise injured in a street car accident. She sued the street car company for damages and received judgment at the last term of court for \$1,500. The judgment was not paid and an executor's sale of the road was ordered by the court. The sale was made subject to all recorded mortgages and taxes, which amount to a little over \$60,000. It is not believed the court will affirm the sale for the reason that it will be impossible for Mrs. Wood to meet the demands of the bondholders or to secure funds to operate the road.

A special dispatch to the Pittsburg "Post" from Canal Dover, O., says: "Anna Mitchener, superintendent on the Tuscarawas electric line between Canal Dover and Uhrichsville, distinguished herself during the recent flood. The electric line was badly crippled, more than two miles of the thirteen being under water. While the flood was at its height, Miss Mitchener hired a livery horse, donned a waterproof habit and went without an escort to the scene of the washout, where she personally directed the work of the employees of the line in guarding the railroad property against damage. She then pushed through water half way up on the horse's side, rode to Uhrichsville, and, without dismounting, returned over the route the same day, making a total of 26 miles."

One of the guests registered at the Hollenden, Cleveland, O., a few days ago was I. Fuyioka of Tokio, Japan, president of the Tokio Electric Railway Company and formerly professor of electrical engineering at the Imperial University of Tokio. Prof. Fuyioka is accompanied by a fellow countryman surnamed Oda. The professor's visit to this country is primarily for pleasure, but in making a tour of the continent he will inspect the electric railway systems of the leading cities and visit the various schools of electrical engineering. Mr. Oda will remain in Cleveland two years, during which time he will be connected with one of the street railway companies, studying practical electrical work as applied to railways.

The Edgerton, Wis., "Reporter" tells this fish story: "One day the past week the Edgerton Electric Light Company were engaged in testing some of the machinery employed at the power station on the Rock river at Indian Ford. The wires leading from the dynamo were run out of the station into the tail race for the purpose of getting a strong resistance to the machine. The wires carried a hot current of 2,000 volts and of course charged the water immediately about with its heavy current of electricity. The river was high and full of fish endeavoring to work themselves up over the dam. Whenever a red-head sucker or pickerel got anywhere near the live wires it took a shock that sent it to the surface, when it would roll upon its back with mouth and gills wide open. Occasionally one more cautious would come close enough to the danger line to get a touch of the current, when it would take a shoot across the river, but the greater portion were easily caught in the trap. A good string of fish could have been taken there in a very few moments."

RECENT COMPANY ELECTIONS.

Citizens' Electric Light & Power Company, Upper Sandusky, O.—Secretary, Frank Tschanen; treasurer, Charles F. Plumb; directors: W. T. Tschanen, George Tschanen, Frank Tschanen, Ed Tschanen, Charles F. Plumb, P. H. Von Blom, M. H. Brinkerhoff.

Easton, Palmer & Bethlehem Electric Railway Company, Easton, Pa.—President, Charles A. Richardson; treasurer, W. L. Kindall; directors: Charles A. Richardson and W. L. Kindall, Worcester, Mass.; Charles E. Barnes and N. S. Myrick, Boston, Mass.; E. J. Fox, T. A. H. Hay and William O. Hay, Easton.

Knoxville Traction Company (reorganization), Knoxville, Tenn.—President, Frank S. Hambleton, Baltimore; vice-president and general manager, G. C. Howell, Knoxville; treasurer, W. S. Shields; secretary and auditor, C. H. Harvey; directors: Frank S. Hambleton, C. W. Boer and John W. Steele, Baltimore; G. C. Howell, W. S. Shields, R. M. Rhea and E. E. McMillan, Knoxville.

Little Falls & Herkimer Railway Company, Little Falls, N. Y.—President, John V. Quackenbush, Mohawk; vice-president, Col. Clinton Beckwith, Herkimer; secretary, N. J. Davis, Herkimer; directors: same as last year with these added: Thomas E. O'Shea, Nathan F. Briggs, New York City; James Conkling and John A. Giblin, Dion; W. F. Lansing, Little Falls. The Utica & Frankfort Electric Railway Company is practically one with the Little Falls & Herkimer.

People's Light & Power Company, Newark, N. J.—President, Philip N. Jackson; first vice-president, Gottfried Krueger; second vice-president, E. F. C. Young; treasurer, Dr. Leslie D. Ward; secretary, L. D. H. Gilmour; general manager, Dudley Farrand; assistant secretary and treasurer, Percy Ingalls; directors: B. M. Shanley, E. F. C. Young, Gottfried Krueger, Charles A. Sterling, William Fairlie, John F. Kehoe, Leslie D. Ward, F. W. Jackson, P. Sanford Rose, Joseph D. Biddle, Charles M. Decker, Abram C. Denman, William Scheerer, William M. Clarke, Samuel Klotz, Peter Hauk, Jr., Thomas T. Kieny, James E. Reynolds, Randal Morgan, James G. Haskins, William C. Shanley, William G. Humstead, Frederick S. Douglas, Uzal H. McCarter, A. Q. Garrison, Matthias Plum, Jr., William Runkle, John D. Harrison, Philip N. Jackson, Dudley Farrand.

Webster & Dudley Street Railway Company, Webster, Mass.—President, Edgar S. Hill; treasurer, John Flint; secretary, Charles Haggerty; directors: Edgar S. Hill, George R. Marble, E. N. Bigelow, Cyprien Danduraud, Oscar Shumway, Lyman B. Eddy, John Flint, Charles Haggerty, Eben S. Stevens.

Woonsocket Street Railway Company, Woonsocket, R. I.—President and general manager, Edgar K. Ray; secretary, Willard Keet; treasurer, Walter Whittlesey; superintendent, H. M. Young; directors: Edgar K. Ray, Willard Kent, Joseph G. Ray, Edward H. Rathbun, Thomas Martin, Charles H. Wilson, Henry L. Whittlesey.

COMMERCIAL PARAGRAPHS.

We would call our readers' attention to the advertisement which appears in this issue of the Gerlach House, located at 55 West 21st street, New York. It is Mr. Charles A. Gerlach's intention to make his well-known hostelry a headquarters for those visiting the Electrical Exhibition to be held in Madison Square Garden during May. With this end in view, every accommodation will be afforded visitors to the Exhibition in the way of a special dining room and reading room, the latter containing the latest and best electrical publications. As this excellent hotel is situated within less than five minutes' walk of the Exhibition it should be well patronized.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address: Sterling Remedy Co., Chicago or New York.

The American Electrical Directory, formerly known as the Standard Electrical Directory, has just made its appearance. It is published by E. L. Powers, Monadnock Block, Chicago, and contains as usual valuable information in the way of electric lighting central station statistics. According to this work there are 2,594 electric lighting central stations operating in the United States, of which 333 are operated by municipalities. The tables in this Directory giving the number of central lighting stations in the various States, with the number of arc and incandescent lights in use, are extremely valuable. The buyers' finding list is gotten up with great care and arranged in alphabetical order with regard to the products sold. As this Directory appears quarterly and the subscription price is but \$1 a year, it should be in the hands of all persons in any way interested in the electrical industry.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

We are in receipt of an attractive catalogue from the Partridge Carbon Company, Sandusky, O. This little pamphlet, containing over thirty pages of reading matter, is handsomely gotten up and should be in the hands of all persons using dynamos or motors and desirous of procuring a high grade of carbon brush.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, acts gently and positively on kidneys, liver and bowels, cleansing the entire system, dispels colic, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

Users of Miniature Incandescent Lamps will very readily appreciate the advantage of having a miniature lamp of a standard, reliable make that can be depended upon for efficiency and length of life. The Packard Sign Lamp, which is a miniature lamp about 2 inches long over all and 1 inch in diameter, fills the demand for a high grade miniature lamp. It is mounted with regular Edison candelabra base, gives about 2 c. p. and burns 4 in series on 50 to 60 volts or 8 in series on 100 to 120 volts. This lamp is car-

ried in stock in Chicago in large quantities by the Electric Appliance Company, who always hold themselves in readiness to ship promptly any number of these lamps and the necessary sockets. This lamp is very largely displacing other miniature lamps for sign work.

INCORPORATIONS.

The Salmon City Electric Light & Power Company, Salmon City, Idaho. Capital stock, \$10,000. Incorporators: G. G. Shaver, William F. Boxwell, William Peterson, W. T. Robinson, R. W. McBride and Ed. Mingle.

The Paterson Trolley Car Appliance Company, Paterson, N. J. Capital stock, \$25,000. Incorporators: Peter D. Milloy, Buffalo, N. Y., and Franz A. Von Mochzisker, Paterson.

The Joliet Railroad Company, Joliet, Ill.—to construct and maintain an electric street railway line in Joliet and other towns, with authority to sell power, light and heat for manufacturing and other purposes. Capital stock, \$600,000. Incorporators: Clinton C. Rush, W. H. Hearn, and A. P. Hirschman.

The Cleveland Electric Light Enlarging Company, Cleveland, O. Capital stock, \$10,000. Incorporators: Jacob J. Denmark, Harry C. Mason, Fred L. Taft, W. T. Black and A. M. Austin.

The Geneva Power & Light Company, Geneva, N. Y. Capital stock, \$50,000. Directors: P. N. Nicholas and F. C. Bloodgood, of Geneva, and S. D. Greene, J. C. Carr and M. A. Oudin, of Schenectady.

The Northern Electric Company, Auburn, Me. Capital stock, \$125,000. President, George O. Wing of Auburn; treasurer, Herbert I. Goas of Berlin, N. H.

The Campbell Electric Traction Company, Charleston, W. Va.—to manufacture and sell electrical and mechanical supplies for railway companies. Capital stock, \$100,000. Incorporators: A. C. Gunther, D. M. Black, Richard Fisher, E. A. Botkin and C. W. Smith, all of Charleston.

The Third-Rail Block System Company, East Orange, N. J.—to manufacture a patented third rail for trolley roads. Capital stock, \$100,000. Incorporators: Louis F. Walkins and J. Warren Wiley of Springfield, Mass.; C. D. Chase of Northampton, Mass., and Howard K. Wood of East Orange.

The M. B. Wheeler Electric Company, Grand Rapids, Mich.—to manufacture and deal in electrical appliances and supplies; also in acetylene gas generators and apparatus; also do a general electrical construction business. Capital stock, \$25,000, of which \$5,000 is paid in. Incorporators: A. Oren Wheeler of Manistee, Morton B. Wheeler of Grand Rapids, and Sigel D. Kopt.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 5, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

601,751. Mechanism for Lowering Car-Fenders. Robert Harris, Bridgeport, Conn., and Marcus K. Goldsmith, New York City. Filed Aug. 24, 1897.

601,961. Fender for Cars. Henry Haywood and George Totten, Toronto, Canada; said Haywood assignor to said Totten; said Totten assignor of one-fourth to Harry F. Lowe, same place. Filed July 13, 1897.

601,965. Car-Fender. John Keller, Philadelphia, Pa. Filed June 25, 1896.

ELECTRIC LIGHTS AND APPLIANCES.

601,860. Clip for Drop-Light Wires. Charles Schuetz, Newark, N. J. Filed Dec. 1, 1896.

601,930. Adjustable Hanger for Incandescent Lights. Fred O. Bell, Cour d'Alene, Idaho, assignor, by direct and mesne assignments, to N. S. Paul, same place. Filed March 26, 1895.

ELECTRICAL MACHINERY AND APPARATUS.

601,717. Solenoid Blow-Out for Dispersing Arca Formed in Breaking Electric Circuits. Sidney H. Short, Cleveland, O. Filed Nov. 1, 1897.

601,871. Electromagnetic Circuit-Breaker. Gano S. Dunn, East Orange, N. J., assignor to the Crocker-Wheeler Electric Company of New Jersey. Filed June 12, 1897.

601,979. Electric Welding Machine. Christen Nielson, Brooklyn, N. Y. Filed June 15, 1897.

601,992. Electric Brake Mechanism. Alexis Vanderbeck, Scammon, Kan. Filed Sept. 13, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

601,768. Printing-Telegraph System. John Barry, Fort Lee, N. J. Filed Sept. 10, 1897.

601,786. Lock for Telephones. Ralph H. Allen, Fitchburg, Mass. Filed Sept. 8, 1897.

601,865. Telephone. Thomas F. Abern, Detroit, Mich. Filed April 26, 1897.

MISCELLANEOUS.

601,694. Machine for Restoring Insulated Wire. Nelson Wilson, Portland, Ore., assignor of one third to Charles Bolen, same place. Filed Aug. 20, 1897.

601,730. Heat-Detector for Electric Fire-Alarm Systems. John D. Gould, Brooklyn, N. Y. Filed Jan. 30, 1896.

601,758. Electric Lantern. Oscar O. Prasse, West New Brighton, N. Y. Filed June 23, 1897.

DESIGNS.

23,452, 28,453. Bulb for Electric Lamps. Edward Miller, Akron, O., assignor of two-thirds to Orlando W. Groff and Anton Rapp, same place. Filed Jan. 29, 1898.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

That Patent Case in San Francisco.

Commenting upon the decision of Judge de Haven at San Francisco, granting the injunction asked for by the Western Electric Company against the use of the Perrin multiple switchboard by the Capital Telephone & Telegraph Company, M. J. Dillman, manager of the latter company, said to a Sacramento Bee reporter:

"The case referred to is one of two suits that were instituted against the Capital Telephone Company by the Sunset-Western Electric-Bell combination in October, 1895, or about the time we commenced doing a telephone business in Sacramento. The first was upon the use of the Watson automatic telephone switch upon our instruments and was decided in our favor.

"This one is upon the use of the Perrin multiple switchboard, and I will say that the decision as rendered does not concern us in the least, as we never have since the commencement of business operated our system under anything but the trunk system, which system is open to the free use of the public.

"While our original board was constructed for either multiple or trunking work, all recent additions have been purely trunking boards, hence our system must be operated under that system and could not be operated under the multiple. Therefore, the suit simply restrains us from using something we do not wish to use and would not use if we could. As for an accounting, that was waived in open court by the Bell attorneys, there being no showing whatever for damages."

The San Francisco call in its report of the decision said: "The switchboard used by the defendant [the Capital Telephone Company] was invented by Thomas J. Perrin and was patented in April, 1885. The court found that Leroy B. Firman had reduced his invention of a multiple switchboard to practice early in 1879 and several months earlier than the other patent."

The N. Y. Commercial states that "D. A. Reynolds, representing the Citizens' Telephone Company, is authority for the statement that in the course of a few weeks a new company would be incorporated in this State (New York) and would probably be known as 'The People's Telephone Company.' The Citizens' is an independent company operating in New York and New Jersey, and using the 'Martin-Cole duplex system.' The new company proposes to charge \$100 per year for unlimited service for New York, \$75 for Brooklyn and \$50 for a limited service of 500 calls. The present flat rate for telephone service in New York City is \$240 per year, with rates for limited service correspondingly high. The patent duplex system, which the company intends to use here, is now figuring in a suit for \$400,000 damages which was begun recently by Charles Martin, who claims to be the inventor, against the Detroit Telephone Company for 'slander of title.' The Citizens' Company, owning the rights to the duplex system through a contract with Messrs. Cole and Martin, will charter the new company which is to operate here."

Attorneys Watson and McCleave, of Pittsburg, Pa., have given notice that an application will be made to the Governor of Pennsylvania on Thursday, April 21, by John Phelps, Martin Meyerdirck, John McCleave, L. H. Mathews and John M. Freeman, under the act approved April 29, 1874, for the charter of an intended corporation, to be called the "Pittsburg and Allegheny Telephone Company," the character and object of which is the constructing, maintaining and leasing lines of telegraph for the private use of individuals, firms, corporations, municipal and otherwise, for general business, and for police, fire alarms or messenger business, or for the transaction of any business in which electricity over or through wires may be applied to any useful purpose. The new company has been organized, it is said, to take up the work of the defunct Home Company and install a complete system of telephones in Pittsburg and Allegheny.

The Pennsylvania Electric Company of Marietta, Pa., has received a large order for telephones from the War Department, to be used for forts, coast defenses and signal stations along the Atlantic coast. The company received instructions to rush the order. This is quite a compliment to the Crescent Telephone apparatus, as no doubt many other makes were considered before the order was placed. The Crescent telephone embodies the latest improvements.

The Southern Bell Telephone Company at Atlanta, Ga., has reduced its price for residence 'phones to \$2 per month, which is the rate set by the new Standard Telephone Company. The officials of the latter company say they rely upon the people to patronize the new company, without whose competition the rates would never have been lowered.

The directors of the West Penn Telephone Company of Washington, Pa., which proposes to cover the entire western and northwestern portion of Washington county, Pa., with a telephone system, are C. O. Cracraft, of Clays-

ville; J. G. Hanna, of Independence; D. K. Irwin, of Claysville; O. M. Henderson, of Washington; D. M. Pry, of Burgettstown and W. E. Thompson, of Claysville, O.

The Telephone bill, which aims at a reduction in rates, was ordered to a third reading in the Massachusetts House on the 1st inst. by a vote of 95 to 61, four members declining to vote as being stockholders in the Bell Telephone Company. The House will probably pass the bill, but its passage in the Senate is extremely doubtful.

A press dispatch from Menominee, Mich., dated April 4, states that "the largest deal in telephone poles ever made in this section has just been closed between Titus & May for the American Telephone Company of New York and A. V. Freeman of Menominee, agent for Raber & Watson of Chicago. It involves a money consideration of between \$75,000 and \$80,000."

The American Telephone & Telegraph Company (Long Distance) has filed with the Massachusetts Commissioner of Corporations the following statement to date of February 28, 1898: Assets—Real estate, \$83,637; cash, debts receivable, \$1,180,710; equipments, etc., \$13,865,665; miscellaneous, \$8,554,966; total, \$23,684,998. Liabilities—Capital stock, \$20,000,000; debts, \$2,223,208; reserves, \$522,063; profit and loss, \$939,742; total, \$23,684,998.

Three telephone companies have made application to the city council of Lancaster, Pa., for franchises to operate in that city. They are the Columbia Telephone Company, the Independent Telephone Company and the Lancaster County Telephone Company. The Columbia Telephone Company has already secured franchises in Elizabethtown, Mt. Joy, Ephrata and Lititz.

The city council of Albion, Mich., has granted a 30-year franchise to the Calhoun County Telephone Company. The company is required to put in free four 'phones for the use of the city; also 'phones, not to exceed ten in number, for school uses at an annual rental of \$12 each.

A prominent business man of Elizabeth, N. J., is quoted as saying that an agreement had been virtually entered into by the big express companies whereby they are to assist the American Bell Telephone Company in its efforts to force local telephone companies out of business.

A telephone franchise in Indianapolis is to be sold to the highest bidder, bids to be opened on the 18th inst. Companies bidding must have \$300,000 of actual stock, and each bidder must deposit \$10,000 in cash with his bid.

The Perry Telephone Company has been granted a 20-year franchise in Guthrie Center, Ia., with many restrictions and conditions in favor of the town. A Bell company is asking for a similar franchise.

An ordinance granting to the Home Telephone Company the right to construct, maintain and operate underground wires in New Albany, Ind., has reached the third reading in the New Albany council.

The Minnesota Central Telephone Company has certified to an increase of capital stock from \$500,000 to \$1,000,000.

The Graceville Telephone Company of Graceville, Minn., has been incorporated with a capital stock of \$200.

New Companies Incorporated.

The Blue Ridge Telephone Company, Stranger, Falls County, Tex.—to establish and maintain a telephone line between Stranger and Marlin. Capital stock, \$1,001. Incorporators: W. S. Hunnicutt, J. C. Shaw and E. J. Garrett.

The Carroll County Telephone Company, Huntingdon, Tenn.—to construct and maintain a telephone line from Huntingdon to Buena Vista. Incorporators: L. P. Clark, A. M. Lee, G. B. Dalton, J. O. R. McCall and J. McN. Wright.

The Pawnee City Telephone Company, Pawnee, Neb.—to put in a telephone system at Pawnee. Capital stock, \$5,000. Incorporators: G. E. Becker, J. M. Rogers, H. H. Bull, J. W. Bullard, E. H. Hollister, S. N. Hoff, A. S. Anderson and W. M. Brown.

The Harrisonville Telephone Company of Waterloo, Ill., has certified to an increase of capital stock from \$8,000 to \$20,000.

The Independent Telephone Company, Lititz, Pa.—to establish telephone lines in Lancaster, Berks and Lebanon counties, Pa. Capital stock, \$25,000. Directors: Israel G. Erb, H. B. Landis, A. M. Amer, P. B. Bucher and A. B. Long, Lititz; E. B. Brubaker, Lexington; S. B. Karl, Millway; E. L. Garber, Stevens; S. W. Buch, Kissel Hill; M. L. Weidman, Ephrata; Jacob Mace, Reamtown; Philip F. Ruhl, Brickerville, and A. E. Lane, Brunnerville.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: cert. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g. gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Albany, N. Y.—Apr. 11:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1% Q. Feb. '98	145	147½
Troy City Railway Co.	100	2,000,000	2,000,000 1% Q. Dec. 10, '97	70	72
Traction Co. (Saratoga)	100	50,000	50,000		
Allentown, Pa.—Apr. 11:					
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	..	15
Bridgeport, Conn.—Apr. 11:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1% Aug. '97	45	60
Baltimore, Md.—Apr. 11:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5% S. July 2, '97	71	72
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000 2% S. Jan. 15, '98	22½	23
Central Ry. Co. of Baltimore City	50	800,000	800,000 6% A. Dec. 1897	80	82½
Boston, Mass.—Apr. 11:					
New England Street Ry.	25	5,000,000	1,081,925 1% Q. Jan. 15, '97	..	..
North Shore Traction Co.	100	4,000,000	4,000,000	10	12
North Shore Traction Co. pfd.	100	2,000,000	2,000,000 6% S. A. & O.	60	65
West End Street Ry. Co.	50	10,000,000	9,085,000 1% S. Oct. '97	81	81½
West End Street Ry. Co. 8% pfd.	50	4,400,000	4,400,000 4% S. Oct. 1, '97	102	102½
Boston Elevated R. R.	100	10,000,000	6,400,000	57	57½
Brooklyn, N. Y.—Apr. 11:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400 2% Feb. 1, 1898	185	..
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	3½	3½
Brooklyn Heights Railroad	100	200,000	200,000	..	..
Brooklyn City RR.	100	12,000,000	12,000,000 2% Q. Jan. '98	198	202
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	..	..
Coney Island & Brooklyn RR.	100	1,000,000	2,000,000 1% Q. Oct. 1, '97	140	150
Kings County Elevated	100	4,750,000	4,750,000	..	..
Kings County Traction Co.	100	4,500,000	4,500,000 1% July 26, '97	45	48
Nassau Electric Railroad	100	6,000,000	6,000,000	30	..
Atlantic Avenue Railroad	50	2,000,000	2,000,000	..	..
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000	74	80
Buffalo, N. Y.—Apr. 11:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	58	60
Buffalo Railway Co.	100	6,000,000	5,870,500 1% Q. Dec. '97	78	80
Columbus O.—Apr. 11:					
Columbus Street Railroad	100	8,000,000	8,000,000 1% Q. Feb. '98	45	46
Columbus Central Street Railroad	100	1,500,000	1,500,000	..	..
Charleston, S. C.—Apr. 11:					
Charleston City Ry. Co.	50	100,000	100,000 8% S. Jan. '97	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	..	..
Chicago, Ill.—Apr. 11:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 3% Q. Dec. 31, '97	227½	231
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	10½	10½
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	8½	4
Met. West Side Kl. const. stk.	100	15,000,000	2,500,000	..	..
North Chicago Street RR.	100	10,000,000	6,600,000 3% Q. Jan. '98	212	..
North Chicago City RR.	100	500,000	249,900	..	..
South Chicago City Railway	100	2,000,000	1,603,200	..	..
West Chicago St. RR. Co.	100	20,000,000	18,189,000 1% Q. Feb. '98	81½	91
Chicago West Div. Ry.	100	1,250,000	624,900 3% S.	..	..
Chicago Passenger Ry.	100	2,000,000	2,000,000 5% S.	..	..
Cincinnati, Ohio.—Apr. 11:					
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000	..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000 2% S. Feb. '98	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	23	25
W. Cincinnati Street Ry. Co.	50	18,000,000	14,000,000 1% Q. Jan. '98	112½	118
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1% Q. Jan. '98	..	..
Cleveland, Ohio.—Apr. 11:					
Arvon, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000 3% Jan. '98	39	40
Cleveland City Ry.	100	8,000,000	7,600,000 1% Q. Oct. '97	62	63
Cleveland Electric Ry.	100	12,000,000	12,000,000 3% Q. Oct. '97	59	59½
Detroit, Mich.—Apr. 11:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100½	..
Pt. Wayne & Belle Isle Ry.	100	400,000	400,000 5% July, '96	175	..
Rapid Railway Co.	100	250,000	250,000	..	100
Detroit Electric Railway	100	1,000,000	1,000,000	..	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton O.—Apr. 11:					
City Railway Co.	100	1,500,000	1,470,600 1% Q. Jan. 1, '98	100	102
City Railway Co. pfd.	100	600,000	600,000 1% Q. Jan. 1, '98	140	145
People's Street Railway	100	1,100,000	..	160	..

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$20 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.
 j \$20,000 of stock owned by North Chicago Street Railroad Company.
 k Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 l \$5 per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$25,000 of stock owned by West Chicago Street Railroad Company.
 m Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 n Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Hartford Conn.—Apr. 11:					
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000 3% S. Jan. '98	140	..
Hartford & West Hartford RR	100	1,000,000	247,000	..	..
Holyoke Mass.—Apr. 11:					
Holyoke Street Ry. Co.	100	400,000	400,000 8% A. Jan. '98	200	205
Hoboken, N. J.—Apr. 11:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8% 1892	70	..
Indianapolis, Ind.—Apr. 11:					
Citizens' Passenger Ry.	..	5,000,000	5,000,000	24	25
Lancaster, Pa.—Apr. 11:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000	..	..
Lancaster & Col. Electric Ry.	..	..	87,500	..	..
West End Street Railway	..	..	..	..	..
Louisville, Ky.—Apr. 11:					
Louisville Ry.	100	4,000,000	3,500,000 1% S. Oct. '97	45	50
Louisville Ry.	100	2,500,000	2,500,000 2% S. Oct. 1, '97	95	100
Minneapolis, Minn.—Apr. 11:					
Twin City Rapid Transit	100	17,000,000	15,010,000	20	25
Twin City Rapid Transit	..	8,000,000	1,714,200 1% S. Jan. '98	..	100
Montreal, Canada.—Apr. 11:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8% S. M. & N.	..	..
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1% S. J. & J.	94	104½
Memphis, Tenn.—Apr. 11:					
Memphis Street Railway Co.	100	800,000	500,000	15	..
New Haven, Conn.—Apr. 11:					
Fair Haven & Westville RR.	25	1,500,000	900,000 4% S. Sept. '97	60	..
New Haven Street Railway Co.	100	1,250,000	1,000,000 2% S. July '98	60	80
New Haven & Centerville	100	700,000	800,000	..	..
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—Apr. 11:					
Canal & Claiborne RR. Co.	40	240,000	240,000 4% S. Jan. '98	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1% Q. Jan. '98	128½	128
New Orleans Traction Co.	100	5,000,000	5,000,000	2	8
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	18	15
Crescent City RR.	100	2,000,000	2,000,000 8% S. Jan. '98	..	30
New Or. City & Lake RR.	100	2,000,000	2,000,000 4% S. Jan. '98	81	88
Orleans Railroad	50	500,000	185,000 1% S. June '94	16	17
St. Charles Street Railway	50	1,000,000	1,000,000 1% S. Jan. '98	58½	64½
New York—Apr. 11:					
Central Croton RR.	100	600,000	600,000 2% Q. July, '97	200	..
Christopher & 10th Sts. RR.	100	650,000	650,000 2% Q. Jan. '98	154	164
Dry Dock, E. B'way & Battery RR.	100	1,200,000	1,200,000 1% Q. Feb. '98	170	170
Metropolitan Street Ry. Co.	100	80,000,000	80,000,000 1% Q. Jan. '98	14	142
Bleecker St. & Fulton Ry. Co.	100	900,000	900,000 1% Q. July, '97	32½	34
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2% Q. Oct. '97	206	212
Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2% Q. Jan. '98	177	188
Eleventh Avenue RR.	100	1,000,000	1,000,000	810	825
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4% Q. Feb. '98	915	850
Ninth Avenue RR.	100	800,000	800,000	92	194
Sixth Avenue RR.	100	2,000,000	2,000,000	195	210
Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4% Q. Feb. '98	810	825
Second Avenue RR.	100	2,500,000	1,862,000 2% Q. Jan. '98	105	..
Third Avenue RR.	100	12,000,000	10,000,000 2% Q. Feb. '98	107	190
42d St., Manhat'ville & St. Nich. Av	100	2,500,000	2,500,000	57	72
Union (Huckleberry) Ry.	100	2,000,000	2,000,000	175	200
Newark N. J.—Apr. 11:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	45½	46
Newark Passenger Ry.	100	6,000,000	6,000,000	..	..
Rapid Transit Street Ry.	100	504,000	504,000 11% S. A.	180	190
Pittsburg, Pa.—Apr. 11:					
Allegheny Traction Co.	50	500,000	500,000	..	45
Consolidated Traction Co.	50	15,000,000	15,000,000 2% S. Jan. '98	13½	..
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000 8% S. May, '97	46½	47½
Central Traction Co.	50	1,500,000	1,900,000	..	..
Citizens' Traction Co.	50	8,000,000	38,000,000 6% S. A.	..	..
Duquesne Traction Co.	50	8,000,000	38,000,000 4% S. A.	..	..
Pittsburg Traction Co.	50	2,500,000	1,900,000 8% S. Aug. '96	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000 3% S. Jan. '98	..	..
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,889 2% S. Aug. '96	..	..
Pittsburgh & Birmingham Trac. Ry.	25	3,000,000	8,000,000 1% S. Jan. '98	..	..
Pittsburg & West End Ry.	50	1,500,000	1,500,000 5% S. June 30, '97	18½	18½
Second Avenue Traction Co.	50	4,000,000	14,000,000	..	..
Suburban Rapid Transit Co.	50	800,000	200,000	..	..

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Croton Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, the corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 4% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 7% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Authorized	Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Authorized	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Apr. 11:							Boston, Mass.—Apr. 11:						
Union Street Railway Co.....	100	\$250,000	\$250,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,630,000	1% Q. Jan. '98.	250	251
Northampton, Mass.—Apr. 11:							Erie Telegraph & Telephone Co.....	100	10,000,000	10,000,000	1% Q. Jan. '98.	64	65
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	100	10,894,600	10,804,600	\$1.50, Feb. '98.	125	126
Omaha, Neb.—Apr. 4:							New York.—Apr. 11:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co.....	100	14,000,000	14,000,000	1% Q.	80	92
Paterson, N. J.—Apr. 11:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1% Q.	104	107
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	188	189
Providence, R. I.—Apr. 11:							Franklin Tel. Co.....	100	1,000,000	1,000,000	2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	3% Q., Jan. '98.	59	62	Erie Telegraph & Telephone Co.....	100	5,070,000	4,800,000	1% Q. Jan., '98.	107	110
Philadelphia.—Apr. 11:							*Gold & Stock Tel. Co. guar. 6%.	100	5,000,000	.....	1% Q.	107	110
Fairmount Park Trans. Co....\$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14%	..	*International Ocean Tel. Co. guar. 6%.	100	8,000,000	.....	1% Q.	108	110
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2% Q., July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	.....	1% Q.	108	110
Hestonville, Man. & Fairmount.....	50	533,900	533,900	8% S. Jan. 10, '98.	61	65	*New York & New Jersey Tel. Co.	100	5,000,000	8,728,000	1% Q. Jan., '98.	140	145
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	.....	2% Q.	71	76
Union Traction Co.....	50	80,000,000	27,930,450	.....	157	16	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	87	90
Electric Traction Co.....	50	.....	8,297,920	.....	71%	71%	*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,625	2% S.	87	90
dCitizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	307	..	*Commercial Union Telegraph Co.	25	500,000	500,000	3% S. Jan. 1, '98.	111	113
dFrankford & Southwark Pas. R.	50	1,000,000	1,875,000	\$14 share A.—Apr. 97	372	..	Western Union Telegraph Co.	..	.....	97,870,000	1% Q. Jan., '98.	85	86
dHigh Avenue Ry. Co.....	50	1,000,000	.....	.....	47	..	Miscellaneous.—Apr. 11:						
dLombard & South Street Ry.	25	1,000,000	1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000	.....	1% Q. Feb. '98.	14	..
dSecond & Third Streets Ry.	50	1,060,000	771,076	\$9 share A., Mar. 97	265	..	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	172	174
dPeople's Traction Co.....	50	10,000,000	6,000,000	3% A., April, '97.	134	135	Chesapeake & Potomac Tel. Co.	100	.....	.....	.....	58	58
dGermantown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1898.	134	135	Chicago Telephone Co.....	100	.....	.....	.....	202	..
dGreen & Coates Passenger Ry.	50	500,000	150,000	3% Jan., 1898.	132	..	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	750,000	750,000	.....	61	78
dPeople's Passenger Ry.....	25	1,500,000	740,000	.....	..	..	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1% Q.	70	75
dPeople's Passenger Ry.....	25	750,000	277,402	.....	80	80 1/2	Hudson River Telephone Co.....	50	2,500,000	2,500,000	2% Q.	112	117
dPhiladelphia Traction Co.....	50	30,000,000	120,000,000	4% S.—Oct. 1, '97.	80	80 1/2	*Northwestern Telegraph Co. guar.	50	.....	.....	.....	87	..
dCatherine & Bainbridge St.	50	1,000,000	400,000	6% A.—Mar., '97.	140	..	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	120	122
dContinental Pass. Ry. guar.	50	1,000,000	540,000	\$6 share—July, '97.	140	..	Southern New Eng. Teleph. Co.....	100	8,000,000	.....	.....	120	122
dEmpire Passenger Ry. Co.....	50	600,000	160,000	.....	180	..							
dPhiladelphia City Pass. Ry.....	50	1,000,000	1475,000	\$7.50 share July '97	178 1/2	180							
dPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	\$3.50 share July '97	86	..							
dRidge Avenue Passenger Ry.	50	750,000	1420,000	\$12 share July '97	300	..							
dPhiladelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July '97	..	..					
d17th & 19th Sts. Pass. Ry.	50	1,000,000	1250,000	1 1/2% S., July, '97	157 1/2	..							
dThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	1835,000	\$11 sh. A., July, '97	273	..							
dUnion Passenger Ry. Co.....	50	1,500,000	1900,000	\$9.50 sh. July '97	227	228							
dWest Philadelphia Pass. Ry.....	50	750,000	1750,000	\$10 share, July '97	225	235							
Rochester, N. Y.—Apr. 11:													
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18							
Reading, Pa.—Apr. 11:													
dReading Traction Co.....	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..							
dCity Passenger Ry.....	50	850,000	850,000	Jan., '98.	112	..							
dEast Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..							
St. Louis Mo.—Apr. 11:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1898.	..	..					
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% Jan., '98.	120	122							
National Railway Co.....	..	2,500,000	2,479,000	1 1/2% Jan., '98.	..	..					
Case Avenue & Fair Grounds.....	..	2,500,000	2,500,000	.....	..	..				
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110							
St. Louis RR.....	100	2,000,000	2,000,000	2% Jan., '98.	95	105							
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% Jan., '98.	170	172 1/2							
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	..	..					
Southern Electric Ry.....	50	500,000	500,000	.....	50	52 1/2							
Southern Electric Ry.....	100	1,000,000	1,000,000	1 1/2% Jan., '98.	100	102 1/2							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	53	55							
Union Depot RR.....	100	4,000,000	4,000,000	8% A., July, '95.	..	175							
San Francisco, Cal.—Apr.													
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	..	110							
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 3/4	53							
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	8%							
Scranton, Pa.—Apr. 11:													
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12							
mScranton & Carbondale Traction Co.	100	500,000	500,000	.....	..	18							
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	..	..				
Springfield Ill.—Apr. 11:													
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11							
Springfield O.—Apr. 11:													
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2							
Springfield, Mass.—Apr. 11:													
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	205	210							
Toronto Canada.—Apr. 11:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	94	94 1/2							
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	..	..					
Washington, D. C.—Apr. 11:													
Belt Ry. Co.....	50	500,000	500,000	.....	..	..				
Capital Traction Co.....	100	112,000,000	12,000,000	65c. per sh. Oct. 97.	72 1/2	73 1/4							
Columbia Ry. Co.....	50	400,000	400,000	6% A.	72	76							
Edgington & Soldiers' Home Ry.....	50	707,000	652,000	.....	9	..							
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	116 1/2	120							
Metropolitan RR. Co.....	50	1,000,000	438,930	2 1/2% Q.	..	..					
Worcester, Mass.—Apr. 11:													
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	16%	18							
*Worcester Traction Co.....	100	2,000,000	2,000,000	3% S., Feb., '98.	94	95							
Worcester & Suburban Street Ry.....	100	550,000	542,500	4% Q., 1897.	85	..							
Wilkesbarre, Pa.—Apr. 11:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Lease to Electric Traction Company.
 g Lease to Frankford & Southwark Passenger Railway.
 h Controlled by People's Passenger Railway at \$5 per share.
 i Lease to People's Passenger Railway by People's Traction Company.
 j Majority of stock owned by People's Traction Company.
 k Lease to Union Traction Company.
 l Lease transferred to Union Traction Company.
 m Lease to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 n Dividend of 10% guaranteed by Reading Traction Company.
 o Dividend of 6% guaranteed by Reading Traction Company.
 p Leased and operated by the Scranton Railway Company, formerly Scranton Traction Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—Apr. 11:												
Fort Wayne Electric Co.....	25	.....	.....	.....	..	..	
Pt. Wayne Elec Co. T. Sec. Series A.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	8 1/2	8 1/2						
General Electric Co.....com.	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	84	84						
T. H. Elec. Co. T. Secur., Series D.	100	.....	.....	.....	8 1/2	8 1/2						
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	20 1/2	21						
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 1/2 % Q., Feb., '98.	61 1/2	68						
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,196,126	.....	..	..			
New York.—Apr. 11:												
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	118	118						
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	8,750,000	1 1/2 % Oct., '97.	108	108						
Edison Ore Milling Co.....	100	.....	.....	.....	..	..	
Edison Electric Storage Co.....	100	.....	.....	.....	..	..	
General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	82 1/2	82 1/2						
General Electric Co.....pfd.	100	10,000,000	4,252,000	8 1/2 % S., July, '98.	88	90						
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	.....	41	..						
United Elec. Lt. & Pow. Co.....pfd	..	.....	.....	.....	..	..
Pittsburg, Pa.—Apr. 11:												
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	..						
East End Electric Light Co.....	50	800,000	800,000	Q	..	10						
Philadelphia, Pa.—Apr 11:												
Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	..						
*Electric Storage Battery Co.....	100	8,500,000	.....	.....	20	22						
*Electric Storage Battery Co...pfd.	100	5,000,000	.....	.....	22 1/2	24						
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	..	..				
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	.....	8 % Oct., '97.	..	..				
Northern Elec. Light & Power Co...	10	6,500,000	550,000	\$82500 dis. Jan. 11 '97	18 1/2	14						
Southern Elec. Light & Power Co...	10	187,500	187,500	.....	10	..						
Miscellaneous.—Apr. 11:												
Brush Electric Co.....	50	.....	.....	.....	87	..						
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	..	..		
Edison Ill'g. Co. (St. Louis).....	25	.....	.....	.....	..	..	
Eddy Electric Mfg. Co.....	25	.....	.....	.....	..	15						
Hartford (Conn.) Elec. Light Co...	100	850,000	.....	.....	120	123						
Hartford (Conn.) Lt. & Power Co...	25	175,000	.....	.....	4 1/2	10						
New Haven (Conn.) Elec. Lt. Co...	100	100,000	.....	.....	148	..						
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	2 % Q., Oct., '98.	88	88						
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	116	120						
Royal Elec. Co. (Montreal).....	..	1,000,000	.....	2 % Q	146	148						
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1 1/2 % Q	181 1/2	183						
Thomson-Houston Welding Co.....	100	.....	.....	3 % S., Dec. 1, '98.	..	..				
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	90	100						

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.	NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.						Authorized.	Issued.				
Albany, N. Y.							New Orleans La.						
Date of Quotation—Apr. 11, 1898.							Date of Quotation—Apr. 4, 1898.						
The Albany Ry. 1st mtg. 5s.		\$29,000	1905				Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*111	....	Crescent City RR. 1st mtg. 6s.	50,000	50,000	1899	M. & N.	101	....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....	Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75%	77
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	350,000	1919	M. & N.	*117½	....	New Orleans City RR. 1st mtg. 6s.	416,500	899,000	1903	J. & D.	104	111
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....	N. Orleans City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	93½	99½
Troy City Railway Co. 1st 5s					*105¾	106½	N. Orleans & Carrollton RR. 3d mtg. g. 6s.	850,000	350,000	1907	F. & A.	110	....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.							Orleans Railroad Co. Cons. mtg. 6s.	800,000	399,000	1912	J. & J.	93½	100
							St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	....
							†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. †\$90,000 outstanding.						
Baltimore Md.							New York.						
Date of Quotation—Apr. 11, 1898.							Date of Quotation—Apr. 11, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn). Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	....
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	....	Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	108
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102½	103	Atlantic Av. (Brooklyn). Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	100	108
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1912	J. & D.	114½	115	Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000		1910	J. & J.	101½	....	Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Baltimore Traction Co. Convertible 5s.	800,100		1910	J. & J.	101½	....	Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	106	108
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	....	Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	....	112	114
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	113	116	Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	....	108½	*107
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113¾	114½	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	115
Lake Roland Elev. 1st mtg. 6s.	1,000,000	1,000,000	1942	M. & S.	110	....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	116
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119 ½	Brooklyn Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	83	85
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. †\$151,000 in escrow to retire 1st mtg. bds.							Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	106	....
							Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	101	106
							Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
							Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	....	92½	94
							Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	....	104	107
							Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	118	115
							Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
							Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	102	105
							D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	115	117
							Dry Dock, E. Bd'y & Bat'y R. scrip 5 %	1,100,000	1,100,000	1914	F. & A.	100	*103
							Eighth Av. RR. Co. Cert. indebt. 6 %	1,000,000	1,000,000	1914	F. & A.	100	....
							12d St. Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	114	116
							12d St. Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	91
							Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	113	117
							Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1997	F. & A.	109½	....
							Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
							Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	100	105
							Steinway Ry. (L. I.). 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
							South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	....	102	107
							Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123	123½
							Twenty-third Street Ry. 1st mtg. 6s.	150,000	150,000	1909	J. & J.	....	....
							Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
							Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	101½	106
							Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	103	105
							†\$1,035,000 in escrow to retire gen. mtg. bonds. †\$4,850,000 in escrow to retire maturing obligations. †\$552,000 in escrow to retire 1st and 2d mtg. bonds. †In treasury, \$80,000. †Guar. by Union Ry. Co.						
							Toronto Canada.						
							Date of Quotation—Apr. 11, 1898.						
							Montreal St. Ry. 1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
							Toronto St. Ry. 1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
							†\$35,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.						
							Philadelphia.						
							Date of Quotation—Apr. 11, 1898.						
							Continental Pass. Ry. 1st mtg. 6s.	350,000	310,000	1909	J. & J.	....	....
							Empire Pass. Ry. 1st mtg. 7s.	300,000	200,000	1900	J. & J.	....	....
							Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	....	....
							Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	....	1901	....	....	....
							People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	....	....
							People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	....	....
							People's Pass. Ry. Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	....	....
							People's Pass. Ry. Stk. tra. cert. g. 4s.	5,698,210	....	1948	....	101½	101½
							Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	....	....
							Philadelphia Trac. Co. Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105
							Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1903	A. & O.	....	....
							Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
							West End Passenger Ry. Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	....
							West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	250,000	1906	A. & O.	....	....
							West Phila. Pass. Ry. 2d mtg. 5s.	750,000	246,000	1926	M. & N.	114½	115
							†The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
							Pittsburg, Pa.						
							Date of Quotation—Apr. 11, 1898.						
							Birmingham, Knox & Allentown. 6s.	500,000	500,000	1981	M. & S.	....	90
							Central Traction Co. 1st mtg. 5s.	375,000	375,000	1930	J. & J.	....	....
							Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	....	....
							*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	....	....
							*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1918	J. & J.	....	....
							*St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	....	108
							Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1923	M. & N.	106	....
							Pittsburg, Crafton & Mansfield. 5s.	250,000	250,000	1924	J. & J.	....	....
							Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	....	....
							Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	....
							Pittsburg & West End. 1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
							*Pg'h, Allegh. & Manch. Gen. mtg. 5s.	1,500,000	1,400,000	1980	A. & O.	109½	....
							Second Ave. Traction Co. 5s.	2,500,000	2,000,000	1934	J. & D.	....	....
							Sub. Rapid Transit Railway Co. 6s.	500,000	500,000	1913	M. & S.	....	....
							Providence R. I.						
							Date of Quotation—Apr. 11, 1898.						
							Newport Street Ry. Coupon 5s	50,000	50,000	1910	J. & D.	....	....
							United Trac. & Elec. Co. 1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	104	106
							St. Louis.						
							Date of Quotation—Apr. 11, 1898.						
							Baden & St. Louis RR. 1st mtg. 5s.	250,000	250,000	1913	J. & J.	100	102
							Cass Ave. & Fair Gds. Ry. 1st mtg. 5s.	2,000,000	1,907,000	1912	J. & J.	102½	103½
							Citizens' Railway Co. 1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107½	108½
							*Comp. Hts., Un. De. & Mer. Ter. 1st 6s	1,000,000	1,000,000	1913	J. & J.	110½	112½

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Apr. 11, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 6s.	400,000	400,000	1906	M. & N.	101	108
Lindell Ry. Co.....1st mtg. 6s.	1,500,000	1,500,000	1911	F. & A.	103½	107½
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	106
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	108	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	112½	118½
*Controlled by St. Louis RR. Co.						
*Controlled by Union Depot RR. Co.						
*Controlled by Lindell RR. Co.						
*\$200,000 in escrow to retire 1st & 2d mtg.						
*\$200,000 in escrow.						
*\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Apr. 11, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferris & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	110
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
*Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Apr. 11, 1898.						
Belt Ry. Co.....U. S. mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home Ry.....mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
*\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Apr. 11, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
Citizens' St. R. (Ind. polis.) 1st cons. m. 5s.	4,000,000	8,000,000	1938	M. & N.	79	80
Croswell St. Ry. (Buffalo).....1st mtg. 5s.	8,000,000	2,866,000	1932	M. & N.	108	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.).....1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	101	102
Croswell St. Ry. (Colu's, O.).....1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1938	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	110½	111
Minneapolis St. Ry.....1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.).....Cons. mtg. 5s.	3,000,000	2,878,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.).....2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.).....Deb. 6s.	500,000	489,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rocheester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	101	102
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
*\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
*\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
*\$750,000 in escrow to retire bonds of O. & St. RR. Co.						
*\$37,000 in treasury.						
*\$50,000 res'ed to redeem prior liens.						
*\$20,000 in escrow.						
*With Interest						

*With int' rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Apr. 11, 1898.						
Edison Elec. Illuminating Co., Boston...	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	100½	.....
Pittsburg, Pa.						
Date of Quotation—Apr. 11, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	106	.....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Apr. 11, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5s.	4,812,000	4,812,000	1910	.....	109	.....
Edison El. Ilg. Co. (N. Y.) con. m. g. 6s.	15,000,000	2,176,000	1938	.....	114½	.....
Edison Elec. Ilg. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	108	.....
Edison Ilg. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	800,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Apr. 11, 1898.						
American Bell Telephone Co. 1st mtg. 6s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telephone Co. 1st mtg. 6s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108½	.....
Chesapeake & Potomac Teleph. Co. 1st mtg. 6s.	.....	.....	1911	J. & D.	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Apr. 11, 1898.						
American Electric Heating Co. 1st mtg. 6s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 6s.	.....	.....	.....	.....	.....	25
Barney & Smith Car Co. 1st mtg. 6s.	.....	.....	1942	J. & J.	98	100
Carborandum Mfg. Co. 1st mtg. 6s.	.....	.....	1904	M. & S.	.....	.....
Washington Pump Co. 1st mtg. 6s.	75,000	.....	.....	.....	.....	.....
*Unlisted						
*Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 11.95@12.10c.; casting, 11½c.

The North Chicago Street Railroad Company has declared its regular quarterly dividend of 3 per cent., payable April 15. Books reopen April 16.

The Brooklyn Rapid Transit Company's earnings on its lines for the month of March were \$468,387; in March, 1897, they were \$407,780.

The Nassau Electric Railroad Company, Brooklyn, N. Y., reports for March gross earnings of \$156,420, an increase over March, 1897, of \$34,143.

The United Electric Securities Company, Boston, has declared a semi-annual dividend of \$3.50 on preferred stock, payable May 2 to stockholders of record April 20. The last dividend declared was in February, 1896.

The plan of the New Orleans Traction pooling committee is said to contemplate reorganization, with an entirely new company. The Louisville "Times" says the May installment of interest will probably be defaulted; an assignment will be made on the stock.

The Boston Gas and Electric Light Commission have prepared a bill to revoke the charter of the Boston Gas Light Company unless the contract with the Brooklyn Company is annulled before December 1.

The Onondaga Lake Railroad Company has, it is stated, made a mortgage of \$400,000 to the United States Mortgage & Trust Company as trustee to cover cost of construction of its road from Onondaga Lake to Syracuse, N. Y.

The Dayton & Western Traction Company, Dayton, O., which has a franchise and right of way to build an electric street railroad from Dayton to Eaton, has mortgaged its road and equipment to the Central Trust Company of New York for \$400,000. This money is to be used to complete and equip the road from Dayton to Eaton, a distance of 25 miles.

An ordinance has been introduced in the Philadelphia council allowing the Drawbaugh Telephone Company to lay conduits, erect poles and to conduct a general telephone business in that city. The company has been making constant efforts since 1894 to get a satisfactory franchise in Philadelphia.

The Van Choate Electric Company has made the following return to the Commissioner of Corporations at Boston: Real estate, \$358,625; machinery, \$68,423; cash and debts receivable, \$54,381; merchandise, etc., \$10,000; patent rights, \$5,990,000; total assets, \$6,486,431. Liabilities—Capital stock, \$6,000,000; debts, \$9,083; balance, profit and loss, \$477,348.

The returns of the Erie Telephone & Telegraph Company have been filed at the State House, Boston. They show the fixed capital of the corporation to be \$5,000,000 and the paid up capital to be \$4,800,000. The assets consist of real estate, \$8,57,268; cash and debts receivable are set down as \$250,895. Total, \$8,758,161. The liabilities are: Capital stock, \$800,000; debts, bonds and notes, \$3,630,500; reserves, \$94,369, and profit and loss balance of \$233,292.

Corporation Counsel Whelan announces that he is going to bring suit at once to set aside the contract made by the former trustees of the Brooklyn Bridge and the trolley companies of Brooklyn, N. Y., for the running of cars across the Bridge. Under that contract the street railroad companies pay to the city 5 cents for each car, but the Bridge receipts for tolls have fallen off about \$1,500 a day. Counsel Whelan thinks the cars ought to pay 25 cents a trip instead of 5 cents.

Several stockholders of the Kings County Traction Company, Brooklyn, N. Y., have applied to Attorney General Hancock for permission to commence an action in the Supreme Court for the appointment of a receiver for that company. The company is about to be dissolved, and the applicants allege that the officials are so under the influence of the persons having control of the Nassau Railway that a receivership is necessary for a fair and equitable dissolution.

April 15 is the day set for the beginning of operation by electricity on the South Side Elevated Road, Chicago. President Carter of the company has notified all of the contractors who have been putting in the new machinery and electrical equipment that the management expects them to have everything in shape for the turning on of the full current on that day. The work of changing the motive power is practically completed. All that remains to be done is to put on a few finishing touches here and there and to make the necessary tests of the machinery to see that everything is in good working order.

A concern which is to bring together the scattered remnants of the acetylene gas enterprise, to wit, the Union Carbide Company, has been incorporated in Virginia with \$6,000,000 capital stock. The failure thus far to make acetylene gas commercially profitable is attributable to its explosive tendency and difficulty of controlling it. Thus far it is said the sale of calcium carbide has been to hundreds of individuals who are experimenting with the view of producing a generator free of danger of explosion and which will keep the odor of the gas from becoming obnoxious.

The Thomson Houston Electric Company's annual statement to the Massachusetts Secretary of State, shows:

Assets:	1897.	1896.	Changes.
Buildings.....	\$371,396	\$343,000	Inc..... \$28,396
Machinery.....	449,713	424,000	Inc..... 25,713
Cash and debts receivable.....	14,557,782	14,933,648	Dec..... 375,866
Manufactured merchandise, etc.	824,376	1,175,656	Dec..... 351,280
Patent rights.....	8,895,050	8,395,050	.....
Total.....	\$19,802,267	\$20,4,9,349	Dec..... \$607,082
Liabilities:			
Capital stock.....	\$10,000,000	\$10,000,000	.....
Profit and loss, surplus.....	9,802,267	10,409,349	Dec..... \$607,082
Total.....	\$19,802,267	\$20,409,349	Dec..... \$607,082

A dispatch to the Philadelphia "Press" from Lancaster, Pa., April 10, says: "Efforts are again being made to reorganize the Pennsylvania Traction system, which has been in the hands of a receiver for nearly two years. William B. Given, representing outside capital, is said to have secured \$550,000 of the \$600,000 bonds issued on the Lancaster City lines, and has also purchased over two-thirds of the bonds secured on the Columbia and Ironville & Donegal roads. Negotiations are now in progress for the Lancaster & Columbia line. It is stated that the Provident Life & Trust Company of Philadelphia is back of the deal, and that several of the best known financiers and business men of Lancaster will co-operate in the new organization."

The Philadelphia "Stockholder" says: "Contrary to general expectation, little interest is thus far manifested in the securities of the new Pennsylvania Manufacturing, Light & Power Company. Both the stock and the bonds were anticipatively regarded as active features of local speculation, and their comparative inactivity is the subject of some comment. Talk of an investigation by the city councils into circumstances connected with the Penn Heat ordinance may have inspired some people with uncertainty regarding the stock, but those well informed on the subject are convinced that no danger is to be feared from this source. The fact appears to be that the status of the new company is imperfectly understood. Constituted as it is of numerous consolidations and absorptions, its relations and obligations to underlying concerns are somewhat puzzling. Good opinion is that the prevailing quiescence, especially in the stock of the new company, will not be of long duration."

ELECTRICITY.

Vol. XIV.

NEW YORK, APRIL 20, 1898.

No. 13.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	vi
Classified List of Advertisements,	viii
Editorial Notes,	225-226
Steel Foundations of Buildings and Electrolysis,	
Power Rates of the Cataract Power and Conduit Company,	
Electrical War Inventions Pouring Into the Patent Office,	
Under the Searchlight,	226
The G. E. Capital Impairment Problem,	
Proposals Invited,	227
Electrical Exhibition Notes,	227
Wireless Telegraphy By W. J. Clarke,	227
Some Recent Improvements in Accumulators and Their Application to Traction on Common Roads, By J. T. Niblett,	230
Electricity Supply in England,	231
Temperature Coefficients of Magnets,	232
Book Review,	233
London Notes,	233
Canadian Notes,	233
Personal,	233
The Trolley Decision,	233
Legal Notes,	234
The News,	234
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous,	
Recent Company Elections,	235
Commercial Paragraphs,	235
Incorporations,	235
Electrical Patent Record,	236
Telephone and Telegraph,	236
Electrical Securities—Stocks, Bonds, Etc.,	237
Notes for Investors,	240

EDITORIAL NOTES.

Steel Foundations of Buildings and Electrolysis.

In view of the fact that electricity is rapidly being adopted as a motive power on the street railways in New York City, and to the fact that extremely high office buildings are constantly being erected, the result of an unofficial investigation which was recently made in Chicago to determine whether stray electric currents were doing any damage to the steel foundations of high structures in that city should prove of interest. General Sooy Smith, who made the examination, makes the following statement, according to the Chicago Tribune:

"Yes, I have investigated certain steel foundations for indications of the action of electrolysis, and found unmistakable evidence that it has begun.

"The work had not progressed so far as to place the building in immediate peril. But the fact that it had visibly started was sufficient to convince me that the electrolysis question is alarming to the last degree. I consider it the engineering problem of the age. An effective insulator for light and power wires must be found, and a means of preventing the escape of electricity into the ground from electric car tracks."

The discovery that electrolytic action is actually taking place in the metal foundations of high office buildings in Chicago is an extremely valuable one, and should serve as a warning to other cities at a time when iron is so extensively used for structural purposes of the above nature. It would seem to have been the general opinion that the metal in most of our high buildings was amply protected against the attack of any stray currents by the surrounding medium, but according to General Sooy Smith such is not the case, as he refers to this important point as follows:

"Insulation is claimed to be an existing protection for steel foundations, the so-called insulator being the cement in which the steel work is imbedded. This is another empty claim, for cement, while not a good electric conductor, is not an insulator by any means. One of its essential elements is unslaked lime, which is not only a conductor but, much more important, one of the greatest known absorbents of moisture. The subsoil under Chicago, it is unnecessary to state, is never dry. The unslaked lime, acting according to its distinguishing principle, must inevitably draw in dampness from the surrounding earth, and thus keep saturated the pores of the composition of which it forms a part. Electricity will find its way through any moisture-containing material. Even though the sand and other elements of cement were non-conductors,

therefore—which they are not—steel foundations would be electrically exposed.

"But argument as to the conductivity or non-conductivity of cement, after all, is idle for purposes of the point in hand. The current need not penetrate the cement in order to reach the steel, nor need it penetrate any crevice in the cement. It can come up underneath and pass directly from the clay to the steel beams or rails in the foundation piers, thence to the columns. Following its rule of choosing the easiest channel for circulation, that is the line on which it will work. The dampness always existing in the strata of soil a few feet below this city's surface suffices to aid the electrolytic decomposition of foundations quite as well as of water and gas pipes."

In the case of foundations of buildings there would seem no reason why electrolytic action should not take place, especially in a city that has innumerable electric railways running through it in every direction and all using the rails as a return. If we are not mistaken, at one time the earth was so saturated with electricity in Brooklyn that an instance is on record where a party by suitably connecting the water and gas pipes in his cellar was enabled to obtain a sufficient amount of stray current to operate a small fan. Such being the case, it is difficult to see why the base of a column forming the substructure of a high building would not be acted on electrolytically under the same conditions.

Mr. Geraldine, formerly city engineer of Chicago, refers to General Sooy Smith's discovery in the above paper as follows:

"Electrolysis I regard as the greatest of engineering problems. It has been considered in connection with other menaces to the permanency of high buildings, but the alarming possibilities that accompany it and the urgent necessity for immediate preventives against its encroachments have not yet been at all properly realized. The time is coming soon, I am satisfied, when it will force itself upon builders' attention as the engineering problem of the age.

"While I have made no direct investigations, I can see no reason whatever to doubt that the underground portions of the tubular supports to the high buildings are already feeling the primary effects of electrolytic action. The current which separates itself from the tracks of electric railroads has full access to the steel foundations. The Elevated loop, which passes within a few steps of some of the tallest buildings in the city, depends upon its rails to return an enormously heavy current to the power station. That a good part of this current escapes from the rails to the structure and thence to the earth and all beneath the earth I feel no doubt. There is no insulation whatever to prevent it.

"It is, of course, unnecessary to remark that the Elevated loop, for a good part of its length, is on the

same street with a surface electric road. The aggregate of electricity passing off from the two must be enormous. There is no satisfactory way to measure it, and thus far we can only conjecture the extent of the damage that it is working."

Unquestionably the solution of this most important problem lies in properly controlling, or keeping within certain limits, the return trolley currents. In practice this has been found almost an utter impossibility without having recourse to the double-trolley system, which, owing to its unsightliness, is prohibitory in large cities. As we pointed out in an editorial some time ago, what is known as the three-wire system might answer the purpose. In this method the trolley line is divided into sections of any convenient length, the positive wire from one dynamo being connected to one section and the negative of a second dynamo to the adjoining section. Thus the line consists of a number of positive and negative sections insulated one from another. The third, or neutral, wire is then connected in the ordinary manner to the rails. This system is said to have proven successful in the few towns in which it has been tried, and although it undoubtedly has objectionable features, as, for instance, were a large number of cars to become bunched on one section the neutral wire would become heavily charged either positively or negatively, and some current would seek the ground as a return; still, taking it all in all, as a means of avoiding electrolytic action, it would seem far preferable to the ordinary trolley. Now that this question of electrolytic action on the foundations of buildings has been brought up, it certainly behooves Chicago to order a careful investigation made. The high metal structures in that city have been erected long enough to show any effect of electrolytic action, and if it is possible for such action to take place, it certainly should in Chicago, where a perfect network of trolley systems exists.

* * *

Power Rates of the Cataract Power & Conduit Company.

The Cataract Power & Conduit Company, which we referred to in an editorial in our issue of March 9, have just published a statement of rates to be charged for electric power in Buffalo. The document issued by the Niagara Company refers to the rate charges as follows:

"The establishment of a system of charges which shall favor no one class of users of power at the expense of others has proved to be a matter of considerable difficulty in view of the great variety of service required. It is probable that in no other city is power used in a greater variety of ways than in Buffalo. We have on the one hand our electric railways and lighting companies, flour mills and factories, requiring hundreds or thousands of horse power, and on the other hand a very large number of manufacturing and other establishments using power only in very small amounts. Again, as regards plants of all sizes within these limits, it is necessary to take into account the fact that while some require power continuously during twenty-four hours per day, others use power intermittently, in some cases averaging only two or three hours per day. As a result of the wide range in the amounts of power which must be kept available for various users and of the radical differences in hours of use, neither the so-called flat-rate system of charges under which each user is charged a certain amount per horse-power kept at his disposal, nor the ordinary method of charging by meter under which each user pays a certain amount fixed by schedule for the actual number of kilowatt hours or horse-power hours used, as recorded by meter, can be adopted without imposing upon one or more classes of users of power charges which are relatively excessive.

"The rates which we have fixed are for Niagara power as distributed from our sub-stations. This is supplied in the form of three-phase alternating cur-

rent, and we are now prepared to deliver it to all points within distances which can be conveniently reached from our sub-stations."

In the editorial referred to above we spoke of the difficulty this company was having in convincing a large number of manufacturers in Buffalo that electricity as delivered from Niagara, a distance of almost 26 miles, could be utilized by them more economically than steam. The schedule of rates has evidently been carefully prepared to accommodate all classes of possible consumers, but, as we have several times stated, it is difficult to see how, under the conditions existing in Buffalo, current can be delivered from Niagara and made to compete with steam other than at a loss to either the producer or consumer. The monthly charge for power will depend upon the actual amount used, as determined by meters installed by the Conduit Company upon the premises of the consumer. The charge will be determined by the record of the meter and by calculation from the schedule. The rates will vary from .64 cent per unit to 2 cents per unit, depending on the number of units used.

Besides the charge for power the Conduit Company also require a monthly payment for service. The latter will amount to \$1 per kilowatt per month. Where a large amount of power is continually used the combined charges would certainly seem extremely favorable to the consumer, and would amount to considerably less than one cent per horse-power hour. Where however but a comparatively small amount of power is intermittently required, say 40 horse power on an average of five hours a day for 26 days in a month, the cost of power and service would amount to about 1.4 cents per horse-power hour.

With steam as a motive power, and assuming a consumption of 4 lbs. of coal per horse-power hour, coal costing \$1.80 a ton, for which it can be purchased in Buffalo, the cost of the same amount of power as above would come to 1.3 cents allowing \$50 a month for labor. This in the course of a month of 26 working days would make a difference in favor of steam of \$16. Under the circumstances therefore, and bearing in mind that a change of motive power means an extra outlay for electrical machinery, it is not to be wondered at that small manufacturers are adopting the proposed innovation but slowly.

* * *

Electrical War Inventions Pouring into the Patent Office.

From all accounts the war excitement has caused a flood of applications for various electrical devices to pour into the Patent Office in Washington. Examiner Seely, chief of the electrical division of the Patent Office, is credited with having devised an electrical dynamite gun for throwing a large number of projectiles in an exceedingly short space of time. The weapon consists of a tube made up of a series of coils of wire—a solenoid in short—which is fed with the explosive shells from a hopper. Along the tube there runs a copper channel, and wires are so arranged as to connect the two ends of the gun with a suitable electric battery. The spherical projectile, as it runs through the tube, closes the circuit at a number of points, its velocity being gradually augmented until it is finally projected from the mouth of the gun with sufficient force, so it is claimed, to throw it a distance of six miles. There are several important advantages claimed for a gun of the above description. It could, in the first place, from behind an embankment, pour a steady stream of bursting projectiles upon a ship at sea without in any way informing the enemy of its location, owing to the absence of both smoke and noise. As the shell in being thrown receives no shock, the chances of a projectile exploding in the tube is reduced to a minimum.

Another original but scarcely practicable electrical device is that suggested by two inventors of Russian birth. Their method consists in utilizing the tremendous heat generated by the electric arc for boring holes in the hull of an enemy's ship. There are various ways in which this could be accomplished, in their opinion, but preferably a submarine boat should be employed. They propose operating as follows: Having reached a point immediately beneath the vessel that is to be attacked, the operator would attach a copper wire to her bottom (it is not stated how this would be done). This wire would then be connected to the negative pole of a powerful electric battery, a second wire being attached to the positive pole and terminating in a carbon stick similar to those used for arc lighting purposes. By then causing an arc to be formed between the metal hull of the vessel and the carbon, the former would be melted, leaving an opening through which water would enter. According to the inventors, it would take but a very short time to bore a sufficient number of such holes as to cause the vessel to founder.

There are also several new inventions which have for their object the substitution of the electric spark for the detonating cap in rifle cartridges. One of these devices is the invention of a Philadelphian, and consists of a magazine gun with a small storage battery in the stock. Each cartridge to be used in a weapon of this nature has two short wires embedded in the powder, the points of which project out of the rear end. The act of pulling the trigger causes these points to be brought into contact with another pair of wires connected with the battery; the circuit being thus closed a spark is communicated to the powder and the cartridge exploded. The main apparent objection to such an arrangement is the necessity of an army carrying a dynamo plant with it during a campaign for the sole purpose of recharging the storage batteries in the stocks of the rifles.

General Edward W. Serrell, the inventor of the hydraulic vertical gun-lift for barbette guns, has, it is asserted, also invented a device by means of which a bolt of electricity can be hurled from a height upon the deck of an enemy's vessel that happens to come within certain bounds. The exact nature of General Serrell's invention is not as yet generally known. It is understood, however, that the device calls for the erection of two towers on opposite banks of a river or bay high enough to allow of a vessel passing under a cable stretched between them. On the latter will operate the electrical engine of destruction, which will be under thorough control from the shore. In connection with the device, and in order to show the exact position of the vessel, there will be an instrument somewhat resembling the range-finder. When a vessel enters a certain zone, a discharge of electricity will take place, so it is claimed, striking the ship's deck and tearing its way through to the water. General Serrell, it is said, perfected his device several years ago, and entrusted the plans and specifications to the Government, which has had them in its possession ever since. So far the details of this new electrical engine of war are known only to General Serrell and certain Government officials, who will not make them public.

Under the Searchlight.

Notes and Comments on Various Topics.

The G. E. Capital Impairment Problem.

(From the Boston Commercial Bulletin.)

Financial Editor Commercial Bulletin:

Can you confirm or deny the reports as to the restoration of the General Electric capital impairment? What are the prospects for the common stock?

J. P. T.

Remarks: Regarding the reports in question, Mr. Samuel Carr of the General Electric preferred shareholders' committee says: "We have held no recent meeting, and nothing has been settled as to what will be done in the matter of General Electric capital impairment or back dividends on the preferred. The matter is a very intricate one. The questions of reducing both the common and preferred stock and giving debenture bonds in the company's treasury for accumulated dividends have all been

under consideration, but nothing has been agreed upon. It stands, however, in a fair way for early adjustment, and it is quite probable that our committee will hold a meeting shortly to consider the matter."

The above will give the stockholders of the General Electric Company an idea of what arrangements were being made up to a few days ago looking to a settlement of the accumulated dividends. Contrary to the statements that had been given out in press paragraphs for months, that a definite arrangement had been arrived at, there seems to have been no conference of the directors even in reference to the matter. Whether the following, which appears in the *Boston News-Bureau* of Saturday, has any better foundation is doubtful, but as it gives some suggestions that are apparently of inside origin it may be of interest to the unfortunate stockholders:

A meeting of the directors of the General Electric will occur May 3, at which time it is expected a final decision will be arrived at regarding recommendations to be made to the stockholders at their annual meeting, which is to be held May 10, as to the payment of the back dividends upon the preferred stock. It is understood that authority will be asked of the stockholders to reduce the capital stock to \$15,000,000.

The particular manner by which the preferred stockholders are to be taken care of is not quite clear. It was at first supposed that debenture bonds would be given for the accumulated dividend, but as the company has destroyed practically all bonds purchased this cannot be done. There are now only \$6,000,000 of these bonds outstanding out of an original issue of \$10,000,000. It may therefore be proposed that the preferred stock be increased by about the amount of the dividends unpaid and reduce the dividend from 7 per cent. to a 4 or 5 per cent. basis.

* * *

The American Sardine Corporation is the title adopted by a fish trust just formed in Maine. It is not the only trust devoted to catching sardines. There are others.

* * *

The *Republican* of Denver, Col., says: "The election in Sterling passed off more quietly than any event of the kind in years. There was but one ticket in the field, the temperance ticket. Out of the 500 votes registered only 98 were polled. Of these the temperance ticket got 90. The ticket elected is: Mayor, Dr. L. E. Stanton; treasurer, F. J. Henderson; trustees, A. C. Sherwin, J. W. Wells, L. W. Gard. The proposition to bond the town for \$12,000 to build an electric light and water works plant was defeated three to one."

The inhabitants of the above community appear to think vastly more of registering than of voting, but what seems stranger under the circumstances is the heavy vote against waterworks. However, you can seldom or never tell how a community that gets along without electric lights will vote anyway.

* * *

REGARDING the recent trolley patent decision the *Boston Advertiser* says: "The general advice was to sell General Electric for a term at least, as the court decision rendering the trolley patents invalid is expected to seriously affect the revenues of this company. These trolley patents were valued at \$8,000,000 by the General Electric Company, and while the company has a large volume of business in sight in other lines the room traders are inclined to the belief that there will be a setback in the price of the stock under the influence of this decision."

* * *

An advertisement from the U. S. Navy Department will be found on page 235 of this issue, giving particulars as to the requirements and pay of electricians who desire to enlist in the Navy.

Proposals Invited.

The Secretary of Agriculture is inviting sealed proposals until May 5 for furnishing the Department with telegraph instruments, etc. Intending bidders can secure specifications and all necessary information upon application to James Wilson, Secretary, Washington, D. C.

Theo. A. Bingham, Colonel U. S. Army, is inviting sealed proposals until May 10 for furnishing electric battery supplies. Information will be furnished upon application to the Office of Public Buildings and Grounds, Washington, D. C.

ELECTRICAL EXHIBITION NOTES.

OFFICES REMOVED.

The managers of the Electrical Exhibition beg to announce that they have removed their offices from 15 Cortlandt street, New York, to Madison Square Garden.

THE TELEGRAPH TOURNAMENT.

The telegraph tournament judges held a meeting at the Astor House, New York, on April 13, among those present being Fred Catlin, T. J. Smith, J. B. Taltavall, H. W. Pope, George H. Guy, A. E. Sink, E. A. Leslie, W. D. Weaver, P. T. Brady, P. B. Delany, S. F. Austin, T. R. Taltavall and William Maver, Jr.

The meeting was called to order by Mr. Catlin, who was elected chairman. J. B. Taltavall was elected secretary. After some discussion it was decided that the conditions to govern the judges in their decisions, as printed in the circular which has been widely circulated, sufficiently covered the ground.

An Executive Committee was then appointed to take care of all matters embraced in the duties of the judges.

The Executive Committee, consisting of Fred Catlin, A. E. Sink, T. J. Smith, P. B. Delany and J. B. Taltavall, held a meeting immediately after the judges adjourned. Mr. T. J. Smith was appointed a committee to arrange for suitable phonographic records, and Mr. P. B. Delany to provide apparatus for chemical or other records not phonographic.

The Executive Committee then adjourned to meet on April 21.

Mr. A. E. Marr, of the Associated Press, an exceptionally good code operator, has been added to the list of judges.

The Smith-Premier Typewriter Company state that those living at a distance who desire to use their machine in the contests need not bring their typewriters with them to New York. Mr. W. H. Durphy, the New York manager of the company, is prepared to furnish all comers with typewriters.

Mr. Fred. E. Barnell, of New York, proposes to enter one or two events in the tournament, more with the idea of demonstrating the fact that telegraphers' paralysis is a curable disease, and giving telegraphers a practical demonstration of his complete cure by electricity itself.

Friday evening, May 13, and Saturday afternoon and evening, May 14, are the dates on which the tournament will take place.

NATIONAL ASSOCIATION OF STATIONARY ENGINEERS.

Arrangements have been made for the meetings of about fifty associations of the N. A. S. E. during the Electrical Exhibition at Madison Square Garden in the month of May. These associations will come from New York, New Jersey, Pennsylvania, Massachusetts, Rhode Island and Connecticut. Several rooms suitable for meetings have been provided, and the various lodges invited almost without exception have accepted the invitation and will hold their meetings there on their regular meeting night as the guests of the Exhibition Company. It is expected that there will be an attendance of at least 5,000 practical engineers (two lodges every evening), and the exhibition management is arranging a registry system, with bulletin boards in different sections of the building, so that exhibitors may know just what associations of engineers are present and the plants with which they are connected.

PERSONAL.

Mr. Samuel Insull, president of the National Electric Light Association and of the Association of Edison Illuminating Companies, was in New York last week. He takes a very lively interest in the progress of the Exhibition, and has informed the management that he will take the utmost pleasure in coming on specially from Chicago, in behalf of those two representative bodies, to participate in the opening exer-

cises on May 2. These exercises, as now arranged, promise to be of an unusually striking and interesting character.

The Pennsylvania Iron Works Co.

A special meeting of the stockholders of the Pennsylvania Iron Works Company was held on the 14th inst. at the general office of the company, Fiftieth street and Lancaster avenue, Philadelphia. Steps were taken, it is understood, to raise additional funds to provide for the company's increased business.

WIRELESS TELEGRAPHY.*

BY W. J. CLARKE.

Mr. President and Gentlemen:—In commencing this evening, I will first of all describe to you the work of my predecessors in the line of wireless telegraphy before telling you what I have myself accomplished during the last few months. Guglielmo Marconi, who claims to be the inventor of wireless telegraphy, is a young Italian, now a resident of London, England, and he certainly deserves credit for having accomplished a great deal in this direction, although he has made use of methods and principles which were well known for many years. In the picture before you of Marconi and his instrument [reproduced below], the transmitter is shown on his right and the receiver upon the left. You will notice that all the apparatus in the receiver is enclosed in an iron box, with the exception of the telegraph sounder. This is done for the purpose of showing that the electric waves will penetrate a mass of solid iron. You here have (see Fig. 1) a diagram of connections showing the method used by Marconi in transmitting signals. In the upper part of the diagram is the primary of an induction coil, which is operated by means of a small storage battery, and in the circuit of which is a Morse key. The secondary of this coil is connected, as you will see, to two brass balls, which are about an inch and a half in diameter, and placed at a distance of about an inch and a half from the two larger brass balls shown, which are about four inches in diameter. These latter balls are separated from each other by about one thirtieth of an inch, and their inner hemispheres are enclosed within a heavy rubber tube, D, which is filled with a superior quality of vaseline oil. When the Morse key in the primary of the induction coil is closed, sparks pass across between all of these balls, and in doing so it will be seen that they have to pass through the bath of oil. These sparks produce electrical oscillations of high frequency, which in turn send out electrical waves into space. These waves travel along until they reach the receiving apparatus, which is shown in the lower part of the diagram. The most essential part of the receiver consists of a small glass tube, d, about an inch and a half in length and one-thirtieth of an inch internal diameter. This tube is fitted with two plugs of silver, tightly fitting, and separated in the center of the tube by about one-thirtieth of an inch, the intervening space being partly filled with a mixture of nickel and silver filings. Two platinum wires are soldered to the outer ends of these silver plugs, and pass out through the ends of the tube, the glass being sealed down upon them so that the air cannot possibly enter the tube, and the filings are thereby preserved from undue corrosion. Attached to each of the platinum wires leading out of the tube is what Marconi calls a wing, which is a metallic plate, W, about a half inch wide, and of such a length as to cause the receiver to be in what we might call "tune" with the transmitter. A small choking coil is attached to the outer end of each of the wings, and the whole is then placed in circuit with this one cell of battery and high resistance telegraph relay, whose contact operates this telegraph sounder by means of this local battery. Now when the filings in the glass tube are lying in their normal state they pre-

*Paper read before the New York Electrical Society.

sent a resistance to the passage of the current varying from 10,000 to 20,000 ohms, but the moment that the key is pressed at the transmitting station, and the sparks pass across the balls, the filings immediately cohere, and their resistance decreases to from 7 to 25 ohms. This great decrease in resistance is, as you will see, sufficient to cause the current of the one cell of battery to pass through the circuit in sufficient quantity to operate the magnets of the relay, and so operate the sounder. It is found, however, that once the filings in the tube have responded to the waves from the transmitter, they remain in the same condition until such time as the tube has been struck a smart tap, when the filings immediately decohere and the tube returns again to its high resistance. Now it is manifestly evident that in order to transmit Morse signals we must have some means of tapping the tube automatically. For this purpose Marconi makes use of a little vibrating arrangement attached to the sounder, the magnets of which are of very high resistance. Now suppose that the key of

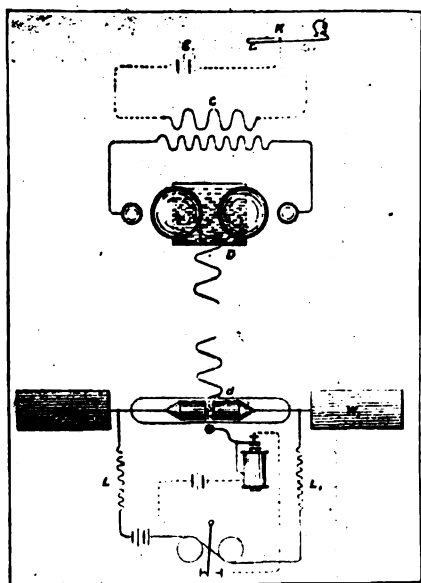


FIG. 1.

the transmitting station is closed, the filings cohere, the relay pulls up its armature, closes the sounder circuit, and at the same instant sets the vibrator attached to the sounder in motion. The tapping of the vibrator against the tube tends to decohere the filings and raise the resistance, but everything is so adjusted that the waves from the distant station are just sufficiently powerful to keep the filings cohering until such time as the key of the transmitter is raised, when the tapping of the vibrator instantly decoheres the filings, the resistance goes up, the relay releases its armature, and the sounder and vibrator circuit is opened. In this way you will see that it is quite possible to transmit Morse signals, but although Mr. Marconi has accomplished wonderful results with this piece of apparatus, which he has very ingeniously devised, it is not that class of apparatus which is suited to the American market, on account of the fact that it requires very sensitive adjustment and very careful management.

I will now describe to you some of my own improvements which I have been successful in making in this class of apparatus. I have designed two distinct sets, each consisting of transmitting and receiving devices. One set is capable of transmitting intelligible Morse signals, and the other is used where a cheaper class of apparatus is desired, and where it is only necessary to ring a vibrating bell, or operate some similar piece of apparatus at the receiving station. The transmitter is the same in both cases, and consists of an induction coil specially wound so as to give the most suitable kind of secondary spark. This coil is mounted upon a mahogany base, together with a specially arranged vibrating device and high class Morse key, the condenser of

the coil being so connected as to kill the spark at the key contact as well as at the contact of the vibrator. On the upper part of the coil are mounted two brass balls which are one and a half inches in diameter and arranged so that the distance between them can be adjusted within reasonable limits. When the coil is connected to a suitable battery, and the key pressed, sparks will pass between these two balls, and electric waves will be sent out into space. I find that the greater the distance between the balls the better the effect, provided, of course, that the sparks

the transmitting station, and on the other hand the plugs in the tubes are so adjusted that the filings will immediately cohere when the electrical waves strike the tube on the key of the transmitter being pressed. The relay in this case is wound to a very high resistance, and is placed in series with the glass tube and one cell of dry battery. Its armature is made as light as possible so as to respond to the most feeble current, and its local contacts are so arranged as to operate the telegraph sounder and the decohering apparatus in multiple, using about twelve



WILLIAM MARCONI.

pass quite freely. I have discarded the use of oil altogether, except in very large transmitters for long-distance work. The receiver consists of two separate instruments, the decohering apparatus mounted upon one base, and a special relay and sounder, together with suitable switches and connections, mounted upon another base. The coherer consists of a glass tube about two inches in length, fitted with two brass plugs, arranged with spring and screw adjustments

cells of dry battery. The decohering apparatus used in the cheaper set of instruments is not provided with as many adjustments as the more expensive set, but these are not found to be necessary where it is only required to operate a signal similar to a vibrating bell. The relay used in the cheaper set is also of a smaller pattern, and is not provided with any means of adjusting the distance between the armature and the magnet cores, these adjustments having to be

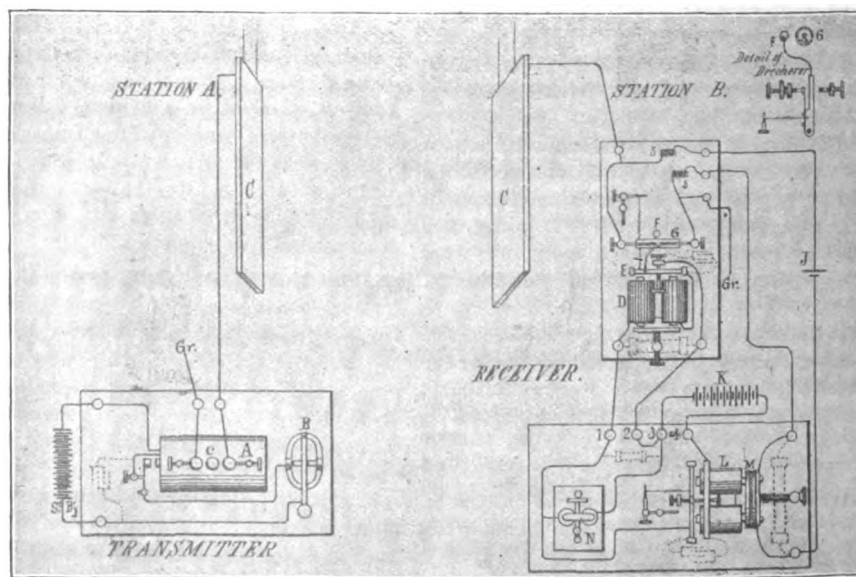


FIG. 2.

to each, so that the distances between the plugs in the tube and their pressure upon the filings can be readily adjusted at will. The magnets of the decoherer are specially wound so as to overcome the effect on the tube of too much self-induction. Every desirable adjustment is provided for, so that not only can we adjust the distance between the magnets and the vibrating armature, but also the tension of the spring on the front of the armature and the distance through which the armature vibrates. In this way we are able to so adjust the coherer that the vibrating armature will strike the tube with just the proper strength of blow, so that the filings will not decohere except on the instant that the key is raised at

made by means of the screws at the back and front of the armature. The relay in this case is mounted on the same base with the electric bell or buzzer which it is intended to operate, and the whole outfit gives excellent results for signaling of this kind. I wish to say here that I have found it necessary to have a special form of dry battery made for this purpose, it being so constructed as not to deteriorate for a very long time, but at the same time it is only intended to be used with apparatus of the kind where a very small amount of current is required. One of our diagrams, giving all the connections of our best apparatus, is shown in Fig. 2. The connections and arrangements of the transmitter which you see upon

your left, at station A, are so apparent that it will not be necessary for me to describe them further than to call your attention to the manner in which the condenser is connected so as to include the Morse key as well as the vibrating contacts. You will notice in this transmitter three brass balls, C, mounted upon the top of the coil. These balls are about three-quarters of an inch in diameter, but, as previously explained, we are now using only two balls of one and a half inches in diameter, and I think we obtain considerable results. One terminal of the transmitter is, as you will see, connected to the ground and the other to plate C, which should be placed as high in the air as possible and very carefully insulated, together with the wire leading to it from the coil.

Now coming to the transmitter at station B, we will commence at battery J, and trace its circuit upwards to the binding-post of the decohering apparatus. From this post it passes through the choking coil, 5, and across to one of the plugs in the glass tube; from the other side of the tube it goes down to the other choking coil, and thence runs direct to one of the binding-posts of the high resistance relay L, after passing through the magnets when it returns to the battery J. You will further see that one terminal of the glass tube is connected to the ground, and the other to plate C, which is placed opposite to and parallel to plate C of the transmitter. Now it is evident that if the resistance of the filings in the tube decreases to any considerable extent, the current from the battery J will pass through the magnets of the relay L and energize them. The magnets will now pull up the relay armature and close the local contact, and in order that you may see clearly what then occurs we will trace out the circuit of local battery K. Beginning on the right, the wire leads to binding-post 4 of the receiver, thence to the front contact of the relay, across the contact to the armature, from the armature over to the sounder N, and from the sounder to post No. 3, and thence back to the battery, the magnets D of the decohering apparatus being placed in multiple with the sounder N through the binding-posts 1 and 2 of the receiver. In this way you will understand that when the armature of relay L is pulled up the sounder N gives the down click and the decohering apparatus D begins to vibrate rapidly, the hammer F striking the glass tube with just that kind of blow required to decohere the filings the instant the waves cease coming from the distant station, and the moment the filings decohere the circuit of the relay L is opened, the armature drops away, the sounder N gives its up click and the decohering apparatus D ceases to vibrate. The only difference between a receiver used for operating an electric vibrating bell or similar signaling device and the one we have just described lies in the fact that the relay is not provided with as many adjustments and is not of such large size, and that the decohering apparatus is of a cheaper grade and also not provided with as many adjustments. This outfit will readily operate the vibrating bell as often as the key of the transmitter is pressed. It is however sometimes found that the bell will continue ringing for an instant after the key of the transmitter has been raised, but for bell signaling this makes little difference, while for Morse signaling it would cause serious trouble, and consequently the high class outfit is absolutely necessary where it is required to transmit Morse signals.

DISCUSSION.

Mr. Dunn—What is the idea of using the plates?

Mr. Clarke—The idea in using plates instead of wings is, if we use wings we will have to place the transmitter and receiver at an elevation in order to secure any satisfactory results at all. Now, by using the plates we can place the receiver and transmitter on the ground floor of the building if we wish, and connect with the plates by well-insulated wires.

Mr. Dunn—When you use the wings they are only a few square inches, whereas the plates are nine or ten square feet?

Mr. Clarke—It is a matter of length more than cross-section. A piece of wire 3-16 inch in diameter is sufficient.

Mr. Dunn—How long?

Mr. Clarke—That depends upon the transmitter. We have used from six inches to three feet six inches.

Mr. Mailloux—Is there any definite relation between the plates?

Mr. Clarke—They should be placed parallel. The results are far better if they are placed parallel. Sometimes you do not get results when they are otherwise placed.

Mr. Dunn—Would the tin roof of a building intercept the signals?

Mr. Clarke—We have not tried that. I have an idea that it would, for the reason that in train telegraphy the tin roof of the car was made use of. I fancy the roof of a building is not insulated, and we find it necessary to insulate the plates carefully.

Dr. Pupin—Would an insulated tin roof be transparent to electric waves?

Mr. Clarke—I don't know.

Dr. Pupin—Have you tried placing the two plates inside of a building?

Mr. Clarke—Yes, sir.

Dr. Pupin—I have tried the effect of the waves upon a coherer placed behind the screen of a tin-pan as a reflecting mirror. The pan was grounded and made a perfect mirror. An electric wave would be reflected nicely by a tin roof I should think.

Mr. Clarke—The experiment is simple to make, and you can do it readily.

Dr. Pupin—Why don't you do it?

Mr. Clarke—We will.

Dr. Pupin—Should nothing intervene between the two plates?

Mr. Clarke—There is some difference of opinion. We have not made any long-distance experiments yet, but for short distances we find it possible to transmit through fire-proof walls for a considerable distance.

Dr. Pupin—Is the coherer a contrivance of Marconi, or who is supposed to have invented this means of receiving wave signals?

Mr. Clarke—I hardly like to say invention, but the coherer is certainly the fundamental part of the whole thing.

Dr. Pupin—The coherer used in 1894 by Lodge worked perfectly—the very same thing. It certainly was not brought before the public previous to 1894.

Mr. Clarke—It was undoubtedly used by Lodge, although Marconi has secured an American patent with fifty-two claims, covering every known form of coherer, and the coherer in combination with the other apparatus.

Mr. Dunn—Can you explain why there is no motion when the particles cohere under the influence of the waves? Is it necessary to give them motion by a blow to make them decohere?

Mr. Clarke—There is great difference of opinion on that point. Few have ascertained so far that that is the case. A great many persons who have looked at the matter casually think that the filings actually move, but under a powerful microscope they show no motion whatever. The only solution I can give for that is that the sparks are produced in contact with the filings, and that possibly something in the line of a welding effect takes place. That was suggested to me by another, who had investigated the matter more thoroughly than I had.

Dr. Pupin—There is always a thin film of air between bodies in contact. This is certainly true of the contact of light bodies. Must you not produce a new film in order to have high resistance, and to do that you have to move the coherer?

Mr. Clarke—There is no motion perceptible under a perfect microscope.

Mr. Dunn—What do you call a perfect microscope?

Mr. Clarke—One magnifying about 2,000 diameters.

Dr. Pupin—How do you wind a coil of a thousand ohms resistance without inducing self-induction in it?

Mr. Clarke—We find it advantageous in winding the relay coil, instead of winding it in one continuous coil to wind it in several different coils, connecting these in multiple so that the combined resistance of the coils will only be a thousand ohms. In order to do that it is necessary to have a magnet.

Dr. Pupin—I do not see how that is going to diminish the self-induction.

Mr. Clarke—It reduces the sparking very greatly; and the sparking of the coherer and relay affects the tube which is in proximity. Sometimes the decoherer operates alone, causes the filings to decohere and open the circuit, and you have to eliminate the sparking almost entirely.

Dr. Pupin—Could you not interpose a metallic screen between the local spark and coherer—would not that do?

Mr. Clarke—We have tried that, and find even a screen a half inch thick has no effect.

Mr. Dunn—I understand that the transmitting device works inside an iron box?

Mr. Clarke—We have tried it by covering it with metal and it works well.

Dr. Pupin—Lodge explains that. You cannot get wires into a box unless there is an opening, and the waves go through the opening. They crawl through the smallest hole, and that is the reason the box does not act as a screen.

Mr. Clarke—The only way to offset that would be to enclose everything in an iron box, batteries and all.

Dr. Pupin—Yes, but you cannot help putting the wires leading to the coherer through a hole in the box. I am sure that a box surrounding completely the coherer and all would act as a screen.

Mr. Clarke—I mean to enclose the battery also in a box.

Dr. Pupin—You have to get from the coherer to the battery.

Mr. Clarke—Can you not enclose the battery in the box, too?

Dr. Pupin—The wires leading from the coherer to the battery have to go through the box.

Mr. Clarke—Not necessarily, if the battery is enclosed in the box also.

Dr. Pupin—How about the plate in the air?

Mr. Clarke—In an experiment of that kind we would not use the plate, but enclose everything in a box and put the transmitter at a short distance.

Dr. Pupin—Perhaps, if you could enclose it entirely in a big iron ball.

Mr. Dunn—The decoherer acts as a sounder?

Mr. Clarke—Yes; I prefer to read the signals from a decoherer. It is impossible to have a sounder work without "chattering." The sounder I show to-night chatters somewhat. That is because the apparatus was made to-day and connected so hurriedly that we have not had time to put in choke coils, resistance coils and condensers.

Dr. Pupin—I do not discredit the invention, but I think there is some ground connection. When we put a screen between, just now, there was no sparking between the spheres, and the arrangement acted just as well.

Mr. Clarke—In order to convince you of that, I think we will connect up our larger coil which we have here for the purpose of exhibiting the fluoroscope to anyone who wishes to see it. I may be wrong, but I hardly think that this coil will give any results when the points are separated so that we will have no sparking.

(The test was made, and was followed by applause.)

(To be continued.)

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

SOME RECENT IMPROVEMENTS IN ACCUMULATORS AND THEIR APPLICATION TO TRACTION ON COMMON ROADS.*

BY J. T. NIBLETT.

Means of vehicular locomotion by the aid of some power other than that of horses is a subject that is now receiving a vast amount of attention. Not only is it of interest to electrical and mechanical engineers and carriage builders, but it has been taken into serious consideration by all those responsible for the regulation of traffic in our large towns. The subject is of such huge importance that it not only affects those whose business or pleasure calls for some rapid and safe means of transport from place to place, but it affects the safety and comfort of the ordinary pedestrian as well. Our present system of horse traffic is open to many objections not only from a humanitarian point of view, but from its sanitarian and economic aspect as well. The streets in our large towns would present a vastly different aspect if, instead of horses, some other means of drawing our vehicles were used.

Much attention has been given to the application of steam, petroleum, and spirits to produce the necessary motive power, but there is but little doubt that electricity will eventually supersede them all, not only on the score of economy, but owing to its freedom from heat, steam, disagreeable odor, and to the ease with which it can be manipulated.

In this communication we do not propose touching upon the numerous applications of electricity for the propulsion of tramway cars and light railways, but we shall devote our attention more especially to the subject of the electrical propulsion of vehicles on common roads by means of batteries. We shall point out some of the recent improvements that have been made in batteries suitable for this purpose, and shall then indicate in a few words how they are best employed, and the most approved methods of dealing with them. An endeavor will be made to deal with the subject in a popular manner, and all technicalities will be avoided as far as possible.

Electro-chemical generators may be divided into two distinct types, viz., primary and secondary. In a primary cell the electrical energy is developed by the direct chemical decomposition of the excitant or electrolyte and one or both of the elements, the magnitude and rate of such electrical development being chiefly dependent upon the chemical activity of the materials employed.

The secondary, storage or accumulator cell, as it is variously called, is the name given to that class of apparatus which is quite inert in itself, but on passing an electrical current through it certain chemical changes are induced which render it capable of receiving, retaining, and then redeveloping a certain amount of electrical energy. The ratio between the amount of energy put in and returned is dependent upon the chemical activity and nature of the materials employed, and also the mechanical construction of the cell.

As a convenient means of obtaining an electrical current of small amount and of short duration, perhaps no electrical generator is so convenient and easily manipulated as a good form of primary battery. But, on the other hand, where cost is a consideration, or where large and continuous currents of uniform pressure are required, primary batteries are altogether out of the question.

Perhaps no other branch of electricity possesses so much fascination for the electrical amateur as the study of primary cells. In the hands of the unscrupulous the primary battery, with its wonderful and oftentimes deceptive allurements, has been for many years past the bait for drawing money out of the pockets of the unwary and inexperienced, and doubtless many thoroughly legitimate electrical enterprises

have been greatly injured by such deceptions as these.

In the best types of primary batteries zinc is used as the decomposable element, and zinc may therefore be regarded as the fuel of this particular form of cell. Sulphuric acid is generally employed as the excitant fluid, and some form of oxidizing agent as a depolarizer is required if only approximate constancy is aimed at. To produce a unit of electrical energy, it is found that, excluding the cost of the depolarizer, zinc is fully 20 times as expensive as coal. Taking into account all losses in a secondary battery and allowing for an efficiency of only 50 per cent., it follows that for continuous and regular working for say such a piece of apparatus as an electromotor the maintenance of a primary battery would come out fully 10 times more costly than that of a secondary battery.

Secondary batteries may be divided into two classes, viz., those in which the active material is formed from the substance of the element itself, either by direct chemical or electro-chemical action, and those in which the chemical formation is accelerated by the application of some easily reducible salt of lead. Elements of the former type are usually termed "Planté," and those of the latter "Faure" or pasted, Messrs. Planté and Faure being the respective inventors.

The active materials in all the best known types of secondary cells, whether of the Planté or Faure pattern, is peroxide of lead in the positive element and spongy lead in the negative. The medium through which the necessary chemical changes occur during either a charge or discharge is a solution of sulphuric acid and water. There is still much doubt as to the precise nature of the chemical changes involved in a lead sulphuric acid cell, due to the action of an electric current, and therefore this matter will not be discussed here. Enough, however, is known to enable those concerned in their commercial manufacture to construct cells of almost any electrical capacity, and capable of taking up and giving out any rate of charge or discharge. It is now usual to speak of any given type of secondary cell as being of so many ampere hours' capacity per pound of plate, or per pound of complete cell. In the latter case the precise nature of the containing vessel, whether it be of glass, earthenware, metal or vulcanite, must, of course, be specified.

PLANTÉ CELLS.

The Planté original secondary cell was of an extremely simple nature, consisting merely of two long strips of thin sheet lead placed one upon the other. To prevent contact between these lead strips a piece of coarse felt was placed between them. This plate was rolled up into the form of a cylinder, and was immersed in a solution of one part of pure sulphuric acid to 10 parts of water. The "forming" process was managed in the following way: The current was caused to pass through the cell until gas was freely given off from the lead plates. On examining the elements, that plate which had been joined to the positive pole of the charging source was found to be coated with a thin film of peroxide of lead. The plate which had been joined to the negative pole was scarcely altered in appearance, neither did it have any electrical capacity. At each successive charging the peroxide on the positive plate was found to sink deeper into the metal. This "eating in" operation was allowed to go on until a sufficient amount of peroxide was formed, or, in other words, until the requisite capacity had been obtained.

In all cells of the Planté type little or no difficulty is experienced in "forming" the positive element. With a negative element, however, the case is very different. Here the active material is chemically spongy lead, and it is only by repeated oxidizing and deoxidizing the metal surface that the necessary depth of this finely-divided lead can be obtained. This is the difficulty experienced in all forms of Planté cells.

The original method employed to produce the desired quantity of active spongy lead was a system of charging, allowing to rest, and then reversing the current through the cell. By each reversal of current the peroxide is reduced by the nascent hydrogen liberated on its surface during the decomposition of the solution, first into the lower oxide, and then into metallic lead in a very finely-divided state. At each successive reversal this oxidizing and reducing action sinks more deeply into the substance of the lead, and by careful treatment any desired depth of active material may be obtained. To form plates by the above process is an exceedingly long, tedious, and therefore expensive operation, and many workers have exercised much ingenuity in devising methods to accelerate the forming operation. To this end Planté himself tried a large number of experiments, the most successful being a preliminary treatment of the lead with dilute nitric acid to thoroughly scour and roughen its surface, and the application of heat to the cell during its formation to open the pores of the metal and allow the electrolyte to penetrate more deeply into it. This, then, is the original secondary cell from which our present-day accumulators have been evolved.

Among the first to improve upon the Planté element was M. de Meritens, who constructed plates made up of very thin lead lamina folded one upon the other like the leaves of a book. M. de Kabath's cell was somewhat similar to De Meritens', but consisted of a thin, cast lead perforated chamber packed tightly in with a large number of lead strips. To allow for the free circulation of the electrolyte, each alternate strip was either fluted or corrugated. Emile Reynier's plate consisted of a thin sheet of lead folded up zigzag fashion, and encased by a stout leaden ring. Cheswright endeavored to improve matters by passing lead plates through suitably shaped rollers, thereby raising on each side a series of dovetailed rims, thus largely increasing the amount of exposed surface. Montaud endeavored to accelerate formation by coating a laminated lead plate with electrolyzed lead.

An early improvement made in our own country was due to Messrs. Elwell and Parker, who used perforated plates of cylindrical form. A number of these perforated tubes were placed concentrically, alternately a positive and then a negative. To retain the elements in position notched vulcanite frames were placed at their base and grooved cross bars of the same material were tightly wedged in at the top.

In addition to various forms of the Planté type of cell already enumerated, many other modifications have been suggested and tried. Few of these early forms have become a commercial success. Probably enough has been said to show the gradual growth from the original cell up to our present-day patterns.

One of the earliest to introduce into this country a commercial cell of the Planté type was Mr. Epstein, and a cell bearing his name has been long on the market. Mr. Epstein has given much attention to the production of accumulators of this type, and in a recent communication to the Institution of Electrical Engineers he promised to shortly introduce an improved form of his plate which he stated was particularly suitable for traction purposes. Such a promise, coming from one so well versed in the subject, leads us to expect a real improvement. The original Epstein plate was made by deeply grooving both sides of a lead plate. The plate, when grooved in this way, was boiled in a solution of nitric acid and water, or some similar solution. This process is said to so corrode the metal that it is easily acted upon electrolytically. Owing to the serrated nature of the plate, the active material appears to wedge itself in the narrow grooves, and does not fall out under ordinary working conditions.

The Crompton-Howell cell, which we do not hear much of now, was constructed of plates sawn from a

* Paper read before the Self-Propelled Traffic Association, Liverpool Center, Eng., March 29, 1893.

cast mass of porous lead. We believe this material was prepared by a system of aerating the metal while in its molten condition. The resulting plate was of a highly porous and crystalline nature, and, owing to its porosity, the electrolyte easily permeated it, thus rendering the formation quite an easy matter.

A form of cell now on the market, known as the "D. P." accumulator, manufactured by the D. P. Battery Company, is also of the Planté type. The elements in this case consist of a large number of narrow strips of lead built up one above the other. By this method a large active area, enabling the cells to be charged and discharged at high rates, is obtained, while disintegration of the active material or buckling is said not to occur. As in the case of the Epstein cell, the plates are chemically treated to accelerate the formation.

The traction cell made by this company is not designed with a view to extreme lightness, but rather with the idea of combining durability with as little weight as possible. The containing case of this particular form of cell is of ebonite, and it contains three plates—one positive and two negative. The weight of the complete cell is about 33 lbs., and three cells are put in a crate for convenience of handling, the weight of the three thus fitted being about 100 lbs.

The capacity of each cell is 100 ampere hours, at a normal discharge rate of 15 amperes; they can, however, the makers state, be discharged at any rate within reason that may be desired without damage to them, the only consequence being a loss in capacity as the discharge rate is increased. The makers assert that with this form of cell a current capacity of four ampere hours per pound of plate, and three ampere hours per pound of complete cell, is obtained.

The "Lamina" accumulator elements, as manufactured by the Lamina Accumulator Company, are made up of a series of perforated and corrugated lead strips. The method of making these plates is somewhat as follows: Lead is received in the form of rolls of 8 to 10 inches wide, and of varying thicknesses of from 1-64th to 1-32d of an inch. The lead is first perforated, and is afterwards corrugated by a suitable machine. After being treated in this way the lead is cut up into strips of the desired size. These strips when built up are encased by a sheet of perforated lead, held in position by leaden rivets, and lead-burnt at the top and bottom.

The forming process is said to take only 36 hours. As the mechanical construction of the plates is simple and strong, they are said to withstand quite well the severe work imposed upon them when used for traction purposes. The makers state that a cell of this form of construction can safely be charged or discharged in one hour. The following data of the company's "As" traction cell may be of interest. The containing case is of ebonite, and is of the following dimensions: 10½ inches long, 4½ inches wide, and 12 inches deep. The complete weight of the cell, with elements and electrolyte, is given as 40 lbs. The dimensions of the positive plates are as follows: 8½ inches long, 7½ wide, and ¾ of an inch thick. The size of the negative plates are: 8½ inches long, 8½ inches wide and ¾ of an inch thick. The discharging rate of this form of cell is 20 amperes, but it may be run up to 100 amperes. The normal charging rate is 25 amperes, but this can also be run up to 100 amperes.

The various types of Planté cells just described are a few of those best known in our own country, and most of these are being used more or less extensively for electric traction purposes.

Having now briefly described the original secondary cell and its developments, we shall turn our attention to a more widely known type.

(To be continued.)

ELECTRICITY SUPPLY IN ENGLAND.

(From our London Correspondent.)

During the first few months of the year it is the custom of most electrical engineers in England, and particularly those in charge of large lighting installations, to inquire into the progress made during the preceding twelve months in the reduction of the generating and distributing expenses for current. The data necessary for such investigation and comparison is easily obtainable, the Electric Lighting Act of 1882 making it compulsory for undertakers of either municipal or company installations to register on or before March 25 in every year an annual statement of accounts of the undertaking made up to December 31 in the preceding year. These statements have to be open for public inspection, and if these conditions are not complied with a fine of 40s. per day is inflicted.

The Board of Trade has so arranged the form in which these accounts have to be drawn up that it is possible to obtain a very accurate idea of the actual working of the plants, for not only has the amount of revenue and working expenses of the undertakings to be shown, but the expenditure has to be analyzed under numerous headings as follow:

1. Coal or other fuel.
2. Oil, waste, water and stores.
3. Wages on generation and distribution.
4. Repairs and maintenance.
5. Rents, rates and taxes.
6. Management, i. e., salaries, stationery and printing, general establishment charges, law expenses, insurance, etc.

A statement has also to be made from which it is possible to easily arrive at the cost of as well as the average revenue arising from the units sold, to discover the load-factor, and to determine the percentage of "quantity not accounted for."

The whole subject of "the cost of generation and distribution of electrical energy" has been exhaustively dealt with by Mr. Robert Hammond before the London Institution of Electrical Engineers. The paper which was read covers 132 pages, and is in itself a small volume, so that it is obviously impossible to publish the complete paper even were it of more than passing interest to electrical engineers in America. Mr. Hammond's paper was advisedly read in abstract, on the evening of March 24, and we propose dealing with the main points.

The author has been connected with the electric lighting industry in England from its earliest days, and he has compiled the following list, which shows the increase in number of plants in operation under statutory powers, or for which statutory powers were subsequently secured, from 1882 up to 1897:

1882..... 2	1886..... 4	1890..... 17	1894..... 81
1883..... 3	1887..... 6	1891..... 31	1895..... 93
1884..... 3	1888..... 7	1892..... 39	1896..... 112
1885..... 4	1889..... 14	1893..... 62	1897..... 121

Having held for many years the view that the general use of electrical energy for purposes other than lighting would result from low costs of production, the analysis of these returns has proved a great fascination for Mr. Hammond, and since 1892 he has published weekly analyses in *Lightning*. The present paper was therefore compiled by him to show the gradually decreasing cost of the production and distribution of electrical energy from electricity supply stations.

The existence of such data is remarked to be unique in the history of English industries, if not in that of the industries of the world, and gas companies would shrink from such a rigid analysis of their cost sheets as that set out by the Board of Trade for electricity undertakings. Although this requirement may seem an onerous one from a general point of view, it is stated to have unexpectedly operated most markedly in assisting the reduction of costs of production and in the lowering of prices to consumers. The publication of the analyses has

acted like an irritant upon the engineers of those works whose costs were high, and as a stimulus to still greater economies on the part of these works. Table I, which covers fifteen pages, sets out, for all the undertakings in the kingdom except the very smallest, the following data: *a*, units sold; *b*, coals used per unit; *c*, average price of coal throughout the year; the costs per unit sold of—*d*, coals or other fuel; *e*, oil, waste, water and stores; *f*, wages (on generation and distribution); *g*, repairs and maintenance; *h*, total of *d*, *e*, *f*, *g*—i. e., works costs; *i*, rent, rates and taxes; *j*, management—i. e., salaries, stationery, printing, general establishment charges, law expenses, insurance, etc.; and *k*, total costs.

In reply to recent criticism that "For about twenty years we have been told that the cost of electricity is to be reduced next year—the reduction has not come yet," Mr. Hammond points out that the prices charged at present are on the average less than one-third of those fixed by the pioneer concerns that started into existence about twenty years ago. At Leeds this year the average price will be 4d. per unit, compared with 8d. per unit five years ago; and at Brighton the charge is 1½d. per unit for all consumption beyond an average of one hour per day, the first hour's consumption being charged at 7d. per unit.

The oldest works in London are those at Kensington, where in 1891 the number of units sold was 385,050, the works cost per unit sold being 3.53d. and the total costs per unit sold 4.91d. These same works in 1896 sold 1,514,729 units, the works cost being reduced to 1.57d., and the total costs to 2.66d.

The Westminster works gave the following results:

	Units sold.	Works costs.	Total costs.
1891.....	627,500	3.32d.	5.32d.
1897.....	4,355,781	1.29d.	2.19d.

The Manchester municipal works gave the following results:

	Units sold.	Works costs.	Total costs.
1894.....	1,168,382	1.49d.	2.17d.
1895.....	1,748,244	1.22d.	1.80d.
1896.....	2,708,598	0.94d.	1.45d.

The works laid out by Mr. Hammond himself at Leeds showed the following:

	Units sold.	Works costs.	Total costs.
1894.....	291,113	2.17d.	3.11d.
1897.....	833,280	0.78d.	1.50d.

The Edinburgh municipal works show:

	Units sold.	Works costs.	Total costs.
1895.....	883,335	0.92d.	1.67d.
1896.....	1,721,557	0.63d.	1.13d.

These and other figures given in Mr. Hammond's tables go to prove that costs of production and distribution tend to decrease year by year as the output increases. The obvious inference is that on still further increased outputs the costs per unit will continue to decrease, and after dissecting the various costs and finding out the lowest cost of fuel at any station, the lowest oil and waste, the lowest wages, the lowest management, etc., of any station, Mr. Hammond draws out some "ideal" figures to show what the total costs would be in an ideal station where everything costs the lowest figures. From these figures he deduces that, if the most favorable features of each works were reproduced in one single works, electrical energy for lighting would be produced and distributed for 0.84d. per unit; but this happy combination necessitates the command of fuel as cheap and as efficiently used as at Aberdeen and Leeds; it necessitates the careful control and use of oil which characterizes Oldham and Leeds; it requires the minimizing of the wages list to the standard of Edinburgh, and the absence of breakdowns to machinery which signalizes the working at Newport; it demands the happy position of freedom of rent and the friendly consideration of the rating authority which obtains at Cardiff and Worcester, combined with the economical apportionment of management charges that prevails at Whitehaven.

The assemblage of all the virtues in one works may come in time, but meanwhile we have to be content with an approximation thereto, and it is satisfactory to find that two of the above named

Help to fight the Electrical Trust by subscribing to **ELECTRICITY**.

works, Edinburgh and Leeds, show satisfactory signs of nearing the goal with increased outputs, both having respectively succeeded in lowering the record of costs per output. In view therefore of the exceptional conditions under which the above ideal costs are obtained, Mr. Hammond does not think it would be right to take 0.84d. as the goal to which the bulk of English works can expect to arrive, and he prefers to direct attention to Mr. R. E. Crompton's carefully reasoned-out ideal standard costs laid before the Institution in 1894. Mr. Crompton then prophesied to a somewhat incredulous audience that the day would come when, with an output of five million units, costs of production and distribution where best coal is 20s. per ton would work out at a total of 1.32d. per unit sold. After the lapse of four years these ideal standard costs have in one case been improved upon, and in two others closely approached, with much lower outputs than the 5,000,000 units fixed by Mr. Crompton. These are Edinburgh, Leeds and Manchester; but in all these cases the coal was obtainable much below the 20s. per ton which Mr. Crompton took as a basis. The lowest costs achieved in the City of London are those of the St. James's Company and the Westminster Company. In the former, on a total of 3,028,212 units, the total cost per unit sold was 2.19d. In the latter on a total of 4,355,781 units, the total cost per unit sold was the same, 2.19d. It is a singular coincidence that both these works, though with widely different outputs, should achieve exactly the same total cost per unit, i. e., 2.19d. These results have been considerably improved upon by provincial plants, even after making allowance for cheaper coal.

The question arises, what are the conditions tending towards such low costs as those recorded? Manufacturers of electrical apparatus, of engines and of boilers, or advocates of certain systems, claim the costs as entirely due to their plant, or the adoption of their pet system; but an examination of the records achieved dispels the illusion that the lowest costs can only be obtained by the use of particular engines, boilers, dynamos, etc., or special systems of distribution. Low costs are rather the result of the combination of favorable conditions. The output is of course the greatest factor in the reduction of costs per unit.

Mr. Hammond gave a number of curves illustrating graphically the relation of works costs per unit to units sold in a number of places. In each place the works costs per unit sold fall rapidly as the output increases from year to year.

Obviously, however, output is not the only influence on costs, for if it were we should find that throughout the kingdom costs were in inverse ratio to output; whereas from record costs shown it is seen that the highest costs are by no means characteristic of the lowest outputs, though the converse does apply—i. e., that the lowest costs accompany the higher outputs. In estimating the influences bearing upon the costs question, Mr. Hammond places load-factor directly after output. Without the latter the most favorable load-factor is useless, but, combined with a healthy output, a favorable load-factor greatly reduces cost. So convinced is Mr. Arthur Wright, the Brighton Borough electrical engineer, of the importance of load-factor, that he offers to supply all his customers at 1½d. per unit, for any consumption beyond an average of one hour per day, of their maximum demand throughout the year. A good deal of data is put forward in the paper showing the load-factor and units used in distribution.

"Reliability of plant" comes in for treatment, and while acknowledging to the full the indebtedness of the profession to those firms of manufacturers who have placed excellence of work above every other consideration, he expresses the belief that in certain cases the pursuit after efficiency has sometimes resulted in the sacrifice of reliability. Perfectly reliable generating and distributing plant has a very important bearing on costs. After completion of

erection of plant on station site, Mr. Hammond always insists upon very rigid and prolonged tests. These tests invariably include ten or twelve hours' consecutive running at full load, two hours' running at emergency load, governing, the whole load to be thrown suddenly on and off, limit of temperature rise at the end of the ten or twelve hours' run. Generally speaking, when plant has passed this ordeal it can be depended upon to cope with almost every emergency arising in the regular course of its work. To run works economically, perfectly reliable plant must first be secured, at almost any cost.

What is termed the "engineer factor" is mentioned as one of the greatest factors, and an engineer in charge must be distinguished for ability, assiduity and earnestness, combined with rigid weekly analysis of his works costs, if the desirable result is to be obtained. The gradual improvement of status in the position of electricity works engineers is encouraging, and though higher salaries will increase management expenses, they will be much more than counterbalanced by the lower works cost. The deplorable niggardliness in some electricity works towards the assistant engineers is not mentioned by Mr. Hammond, and as it only prevails in a few exceptional cases it need hardly be taken into consideration.

Efficiency of generating plant, efficiency of distribution and all round efficiency are considered briefly, and the author then proceeds to consider the range of ultimate costs of production and distribution. The effect of output, load-factor, reliability of plant, engineer factor, etc., in this connection is also viewed. In provincial towns and cities, if not in the metropolis, the supply of electrical energy for tramway traction would afford a splendid day load; and works that succeeded in reducing their costs on a lighting load to, say, 1.50d. per unit (total costs) would probably have the costs reduced to 0.75d. by the addition of one million units delivered to the tramway feeders between the hours of 6 A. M. and 10 P. M. Unreliable plant should be weeded out and replaced by solid high-class apparatus, or decreased costs cannot be expected.

At the conclusion of his very useful and interesting paper, the author, like Mr. Crompton on a previous occasion, ventured a prophecy as to the reduction of costs in works situated in an industrial center. He prophesies that when the Leeds output reaches the ideal figure of five million units the costs of production and distribution will work out at .75d. per unit sold (total costs). Seeing that the Leeds output for 1897 was only 833,280 units, it would seem that the time referred to is not immediately upon us.

TEMPERATURE COEFFICIENTS OF MAGNETS.

The results of an interesting investigation, made by Mr. J. R. Ashworth to ascertain what kinds of iron and steel are least liable to a change of magnetic intensity under moderate fluctuations of temperature, were recently communicated to the Royal Society by Prof. Schuster. Specimens of steels containing severally tungsten, manganese, cobalt and nickel, also specimens of cast irons, of different blends of pig irons, and of different percentages of carbon, were procured from a number of different English and Scotch firms. The size of these specimens was in general about 15 cm. long and 1 cm. or 2 cm. thick, and the course of an experiment was as follows: The rod or bar in its normal state, or after being hardened or annealed as occasion required, was magnetized between the poles of a powerful electro-magnet excited by a battery of twenty-six storage cells. The magnet was then fixed rigidly in a horizontal tube, through which a stream of cold water and steam could be alternately passed. The tube and its contents were placed at a convenient distance from a sensitive dead-beat magnetometer and at right angles to the magnetic meridian. The deflections of the magnetometer needle were read

by the usual mirror and scale, and from the readings were deduced directly the temperature coefficient and the total irreversible loss of magnetism. The process of heating and cooling the magnet was continued until the intensity fluctuated between two nearly constant values corresponding to the temperatures of the cold water (10 or 20° C.) and steam (100° C.). The coefficient α was then calculated by inserting these values in the equation $I' = I(1 - \alpha t - t)$. The author found that the temperature coefficient is generally least in the hardest irons and steels, and is particularly small in hardened cast iron. Certain hardened nickel steels had very small negative coefficients, i. e., underwent an increase of magnetic intensity with increase of temperature. Experiments were also made with pianoforte wire, lengths of 12 cm. each being out from a coil of the wire and tested after various treatments. Magnetized in the normal state this material gave a negative coefficient. When heated to bright redness and chilled rapidly or slowly the coefficient became positive. As it was thus possible to change the sign of the coefficient, an attempt was made to find the particular temper which would give a zero coefficient. Lengths of the wire were heated severally in oil to 200 degs. and 260 degs., and in air to a temperature producing a film of oxide, and rapidly chilled in water. The coefficient still remained negative, and of nearly the same magnitude. But when heated to dull redness and quenched, the coefficient was very nearly reduced to zero. Heated to higher temperatures and quenched, the coefficient became positive. In some steels it was also found possible to change the sign of the temperature coefficient by alteration of the ratio between the length and diameter of the bar. Some relations between this "dimension ratio" and the self-demagnetizing factor, temperature coefficient and permanent loss of magnetism after alternate heatings and coolings were also investigated. Experiments are in progress with the object of procuring a steel with a zero coefficient, but adjusting the temper and dimension ratio. The complete paper, with curves and tables, is published in No. 382 of the *Proceedings of the Royal Society*.—*The Electrician, London.*

BOOK REVIEW.

MODERN SWITCHBOARDS. By ALBERT B. HERICK. Published by the Cutter Electrical and Manufacturing Co., Philadelphia. Pp. 222. Price \$3.

This work, as the title indicates, is devoted to the description of switchboards, switches and similar appliances. The book is divided up into eleven chapters as follows: Circuit-breaking Devices, Switchboard Construction, Switchboard Appliances, Protective Devices, Low Tension Switchboards, Low Tension Central Station Switchboards, Railway Switchboards, Alternating Current Switchboards, Arc Light and Special Switchboards, Circuit-breakers and their Use in Power Transmission, and the Development of the Circuit-breaker. The introduction gives an extremely interesting historical sketch of the switchboard, and points to the various steps that have led up to the present practice. The work itself contains a great amount of useful information and is fully and handsomely illustrated throughout. This valuable addition to the literature on the above subject should certainly be in the hands of all those in any way connected with central stations, either as operators or designers.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LONDON NOTES.

[From our London Correspondent.]

The Telephone Service.

There has for years past been widespread dissatisfaction with the English telephone service, and the British Parliament has now resolved to appoint a select committee to go into the whole question, especially taking into account the positions of the National Telephone Company and the British Post Office in regard thereto. One of the special points which this committee will have to consider is whether the telephone service is of such public benefit as to justify a municipality in using public funds for working the telephone within its area. The committee will sit almost immediately and will cover the matter in about half a dozen sittings, reporting to Parliament before it prorogues.

Nottingham Electric Tramways.

The Corporation of Nottingham has been investigating the question of mechanical traction, and after considering the cable, conduit and accumulator systems, has resolved in favor of the trolley. The Corporation will buy up the city lines, carry out extensions, and equip them all with electric power, at an estimated outlay of \$2,200,000.

Municipalities and Electrical Work.

Electric lighting undertakings are making good progress financially in the hands of English local authorities, but it has just been held by a Leicester County Court judge that it is illegal for municipal authorities to carry on business as electricians and wiring contractors, as the Electric Lighting acts do not include such a provision. This point was raised by an electrical contractor who purchased lamps and fittings from the Corporation and then refused to pay for them in order that when the matter went to court he might test the legality of the Corporation trading in materials. He has been ordered to pay the bill, but the judge decided in his favor on the point raised. As there are several English Corporations trading in a small way on somewhat similar lines, the matter was considered of considerable importance to the electrical tradesmen who were thus placed in direct competition with the local authority to whom they were ratepayers. The point may yet be contested in a higher court.

CANADIAN NOTES.

The Montreal Street Railway Company is building twenty motor cars for the Kingston, Jam., street railway.

The Halifax, N. S., Electric Street Tramway Company will spend about \$50,000 in improving their plant. They have just installed two large generators.

E. F. Hutchings and others, of Winnipeg, Man., ask power from the Provincial Legislature to construct an electric or steam railway from Winnipeg along the east side of Red River to St. Andrew's Rapids.

In respect to the proposed auto car service to be established between Toronto and Richmond Hill this summer, it is said the initial car will be fitted with electric lights, and buttons for the use of conductors and passengers by which a warning may be given the motorman to turn to the right or left. It is claimed that this car will develop sufficient power to ascend heavy grades between Toronto and Richmond Hill at a speed varying from 6 to 12 miles per hour, carrying a full complement of passengers.

By an agreement entered into upon the commencement of the road, Mr. J. H. Beemer had a two years' option for the purchase of the Quebec Street Railway. It is now said to be his intention to purchase the road, and to consolidate it with the Quebec, Montmorency and Charlevoix Railway. The motive power of the latter road will at once be converted from steam to electricity. Later on an extension of the road will be made to Murray Bay.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

Personal.

Few men are better known in the electrical field than Mr. Edward R. Knowles, the electrical, civil and mechanical engineer, and the trade will be interested to learn that Mr. Knowles has become identified with the Sprague Electric Company, where he will have entire charge of their power motor department. Mr. Knowles is so well known that it is almost superfluous to say much about him. He is a Californian by birth, but his work and life have been

almost entirely in the East, where as an engineer for electrical installations, in his specialty of supplying electric motive power to all classes of machinery, and as consulting engineer for the New York and Brooklyn Bridge Company and scores of other corporations, he has attained a very enviable reputation. Mr. Knowles' career as an inventor, and in the developing, perfecting and rendering commercially successful the ideas of others, has been more than noteworthy, and his all-round reputation and ability will surely prove of great value to the Sprague Company. His engagement furnishes additional evidence that the Sprague Company is determined to have the best men in the right place, and both the Sprague Company and Mr. Knowles are to be congratulated on their new alliance.

THE TROLLEY DECISION.

What the Walker Company Thinks of It.

The Walker Company of Cleveland, O., which was the real defendant in the suit of the General Electric Company against the Union Railway Company of New York, has issued a circular containing the recent decision of the Court of Appeals and a preface thereto giving a synopsis of the proceedings leading up to the decision. The following is the story in detail as given in the circular:

The long story of harassing litigation on the question of the right of manufacture by independent electric companies of the overhead trolley is finally closed.

After months of fighting and repeated efforts of the trolley trust to prevent all competition in the manufacture of this important item in the equipment of the electric car, the Walker Company has secured a final verdict from the highest court which absolutely prevents further annoyance of its customers and makes the trolley absolutely free.

The case was considered closed when on July 23d, 1897, the U. S. Circuit Court of Appeals, Second Circuit, handed down a decision setting aside the injunction granted by the lower court against the Hoosick Railway Co. (the Walker Co.'s customer) on all except claims 2 and 4 of the Van Depoele patent.

Not satisfied, however, with this reversal of the lower court's decision, the General Electric Company again brought suit in February, 1898, against the Walker Company, this time through another customer, the Union Railway Company of New York.

This suit was brought on claims 2 and 4 of the Van Depoele patent, which were used simply as a last resort, as they were of so broad a nature that it was considered futile to bring them to trial in the first place.

The lower court again gave a decision for the plaintiff but refused to grant an injunction. A prompt appeal was taken, and, as before stated, the decision was rendered April 7, declaring the clauses null and void, and making the trolley free for all time to come.

The suits were brought by the General Electric Company in the name of the Thomson-Houston Electric Company, which is an integral part of the former concern.

The importance of this decision can hardly be overestimated. The General Electric Company considered these patents of such import that they were counted as a large per cent. of the \$3,000,000 of assets represented by patents controlled by the Trust.

We quote from President Coffin's annual report, submitted April 27, 1897:

"The courts have invariably recognized the validity and controlling importance of the Van Depoele patents on the electric railway trolley and switch system, and at the present time substantially all manufacturers of infringing trolleys and switches are under injunction. The company has met with no reverses in its patent litigation during the past year."

During the past year the Walker Company has rendered invalid two important motor patents and all the trolley patents controlled by the Trust, and one cannot help looking forward with interest to that part of the forthcoming General Electric report which will deal with the patent situation.

It is hardly necessary to say, in view of the foregoing, that this trolley patent was considered the most important and valuable controlled by the General Electric Company.

A word concerning the policy of the Trust will not be out of place here. Its policy has always been that of intimidation, and it has endeavored (successfully in many cases) to force all competing concerns

to the wall. The Walker Company is to-day the only independent concern manufacturing all types of electric machinery which has successfully competed with the Trust and which has had the resources and determination to resist its continual attacks. Its magnificent record in the past in defending its customers from malicious suits can be referred to with pride, and one by one the all-embracing claims of the Trust are being set aside.

LEGAL NOTES.

Judge Woolson of the U. S. District Court at Keokuk, Ia., has handed down a decision against J. C. Hubinger for \$22,760 and interest from June 10, 1896, in favor of the Central Trust Company of New York. In January, 1894, the Central Trust Company foreclosed a mortgage on the Gate City Electric Street Railway at Keokuk. Mr. Hubinger bought the property on April 29, the same year, for \$10,000. The sale was opposed by the Central Trust Company and appealed to the Supreme Court of Iowa, which two years later ordered a new sale. In the meantime Mr. Hubinger had improved and finally disposed of the property to a corporation which he formed. The Central Trust Company sued Mr. Hubinger for conversion of property and has been successful.

In the suit brought by the city of Indianapolis against the Citizens' Railroad Company, the Circuit Court has rendered a decision in conformity with the law passed by the last Legislature, ending all street railroad franchises in Indianapolis January 1, 1901. The Citizens' Railroad Company claims that its charter is perpetual, and will appeal to the Supreme Court.

The Imperial Electric Company, New York, was sold out by the sheriff on the 11th inst. The property brought \$160.

The sheriff has received an execution against the Electric Self-Playing Piano Company, of 66 East Houston street, New York, for \$5,278 in favor of Hattie C. Davis on an assigned claim of George Howlett Davis for services and money loaned to the company in the last three years. He was secretary and treasurer, and Frederick C. Alden was president. The company was incorporated in August, 1895, and capitalized at \$100,000.

THE NEWS.

What is Going On in the Electrical World.

Bordentown, N. J.—The council has passed an ordinance granting the right of way through the city to the Monmouth Traction Company.

Brooklyn, N. Y.—The representatives of the street railroad companies whose cars run on the bridge held a conference with the Department of Bridges officials a few days ago on the question of tolls. During the conference the representatives of the companies said that the cost of running cars over the bridge had been averaged up to be 20 cents each trip. The power required to propel them costs 7 cents, 13½ cents were required to pay for additional labor and 3½ cents for additional inspectors, besides the 5 cents paid the city for toll. They said that up to the present time the passengers had averaged fourteen to each car. They submitted that when the cost of transporting the passengers to the various parts of Brooklyn was considered, the railway companies were putting themselves to a great extra expense and could hardly be asked to pay a larger toll. The representatives admitted that an average of 100,000 persons had ridden over the bridge on the trolley cars every day. They promised Bridge Commissioner Shea to prepare sworn statements as to the cost of operating the cars on the bridge and the receipts and number of passengers carried.

Buffalo, Wyo.—A proposition to construct an electric line from this place to Clearmont station on the Burlington & Missouri Railroad, 32 miles distant, is being considered by an Eastern company located at Syracuse, N. Y. The road would be used primarily for freight traffic, and it is believed would prove a profitable investment on the amount required to construct the line, which would be under \$4,000 a mile.

Columbus, O.—Senator Burke's street railway franchise bill is indefinitely postponed. The bill provided that franchises should not be granted to street railway companies for more than 25 years, and that subsequent franchises should not be for more than 15 years and be granted during the last year of the first franchise. There were but 10 votes in its favor.

Delaware, O.—The Delaware Electric Street Railway was offered at public sale for the second time on the

11th inst. There were no bidders. The road is appraised at \$35,000. The court has ordered the road reappraised and again advertised.

Jackson, Miss.—The city council has granted a franchise for an electric railroad and light plant, this time to Gen. W. T. Carnes of Memphis, Tenn., and H. H. Corson, representative of the General Electric Company of New York. The franchise is the same as was granted last summer to Mayor McKisson of Cleveland, O., and associates, except that work is to begin in sixty days, and five miles of roadbed to be completed in seven months from date of franchise, a thirty days' discontinuance of work after being begun to forfeit the charter. The city agrees to take 120 arc lights at \$114 each per year for ten years. Work on the light plant is to begin in five months.

Laporte, Ind.—The county commissioners have granted a franchise to the Hon. John W. Lovett and W. H. Huffman of Anderson to build an electric railway from Laporte to Michigan City, a distance of 12 miles. A survey of the line will be made at once.

Mechanicsburg, Pa.—The Harrisburg & Mechanicsburg Electric Railway Company has accepted the conditions imposed by the borough council of Shiresmantown for right of way through that town, and operations will at once commence to continue the trolley from White Hill to that town, and thence to Mechanicsburg.

Newport News, Va.—The council of Hampton has granted right of way through that town to the Newport News, Hampton & Old Point Railway & Electric Company which proposes to compete for passenger traffic between this place and Old Point with the line already in operation.

Portland, Ore.—The Northern Railway & Improvement Company of this city has become the owner of all the right of way, franchises, cars, buildings, power house, tracks, etc., of the New Whatcom (Wash.) & Fairhaven Street Railway Company, and thereby succeeds to all the interest therein of the Thomson-Houston Electric Company. Some needed improvements will be made in the road at once.

Quincy, Ill.—The city council has passed an ordinance granting J. C. Hubinger a thirty-year street railway franchise, specifying the streets through which the line must run.

Richmond, Va.—At a meeting of the Richmond & Petersburg Electric Railway Company in this city on the 9th inst., Corbin Warwick of Richmond was elected president of the company, and John S. Primrose of New York vice-president. It is the purpose of the company to push the enterprise to completion. The line will be about 20 miles long.

Saginaw, Mich.—Mayor Baum in his message advocates the purchase and operation by the city of the electric street car lines, now in the hands of the receivers. It is proposed to get legislative enactment permitting Saginaw to buy the entire system and either run the cars under municipal control or lease the tracks to a private corporation. Mayor Baum suggests a non-partisan commission to govern a street car department under civil service regulations. This, he says, will end the trouble which the city has had for several years and the result will be a benefit to the municipality.

San Francisco, Cal.—Manager Vining of the Market Street Railway has under consideration a plan to operate a through line of electric cars to the Cliff House and ocean beach. The new line will be operated as soon as the road now being built on H street south of the Park is completed. This will be about the 15th of next month. The proposed through service will be run in conjunction with the Ellis and O'Farrell street electric line.

LIGHTING PLANTS.

Allegheny, Pa.—The bids for furnishing a dynamo for the electric light plant were as follows: Western Electric Company, \$1,900; the Fort Wayne Electric Corporation, \$2,000, and the General Electric Company, \$2,038.

Alton, Ill.—The bond for \$10,000 filed by Receiver James Duncan of the Alton Gas & Electric Company has been approved by Judge Hope, and the judge has entered an order giving Mr. Duncan possession of the property.

Annapolis, Md.—By an act of the Legislature the corporate authorities of Takoma, Md., are empowered to bond the town to the extent of \$10,000 and employ the proceeds to establish a water and sewer system and electric lights.

Brooklyn, N. Y.—The War Department will, it is said, install an electric searchlight of 20,000 candle power on top of the iron observatory at Surf Avenue and West Third street, Coney Island.

Chelsea, Mich.—The village has voted to borrow the sum of \$13,000 to be used exclusively in the purchase of the local electric light and waterworks plants.

Davenport, Ia.—The Consolidated Gas, Electric Light & Steam Heating Company has filed amendments to its articles of incorporation changing its name to Davenport Gas & Electric Company and its capital stock from \$400,000 to \$800,000.

Elmira, N. Y.—Sealed proposals will be received until May 2 for lighting the city streets by electric arc lights (240 or more) for one, three and five years from Novem-

ber 7, 1898. Information can be obtained by addressing M. H. Murphy, city clerk.

Lamar, Col.—The proposition to grant a franchise for electric lighting to a responsible company was carried at the recent election.

Long Branch, N. J.—The commissioners rejected all bids offered for lighting the city, and will have to advertise again. It costs at present \$13,000 or \$96 per lamp for lights, and the mayor and commissioners consider \$10,000 sufficient.

Milwaukee, Wis.—H. M. Green, of this city, who owns a twenty-five year franchise for furnishing electric lights in South Milwaukee and operates a plant there, offers to sell outright to the city his entire plant at an annual payment of \$90 per year for each of thirty-one lights, or \$2,723 per year for ten years, at the end of which time the entire property passes to the city.

Mechanicsburg, Pa.—Proposals for lighting the streets of the borough of Mechanicsburg, Cumberland County, Pa., will be received until May 10. The requirements are for 47 or more arc lights of 1,600 cp., and 12 or more incandescent lights of 32 cp., the bids to specify price for all night lighting or until 12 o'clock nightly. Bids should be addressed to C. N. Owen, chairman light committee, Mechanicsburg.

Mount Olive, N. C.—J. D. Williams of Kenansville will own and operate the electric light plant now under construction in this place. He expects to have it in operation by May 1. Mount Olive has only about 1,200 inhabitants and is the smallest town in the State to introduce electric lights.

St. Louis, Mich.—The citizens by their vote at the recent election decided to bond the town for \$20,000 and purchase an electric light plant.

St. Paul, Minn.—The board of public works has decided to immediately abolish thirty gasoline lamps and about an equal number of gas lamps on the west side. In place of these lamps twelve arc lights will be supplied. The electric lights will be furnished by the Edison Heat, Light & Power Company at their bid of \$94 per light per year, for an all-night service.

Superior, Wis.—The committee on city and commercial lighting plant advertise for bids for the construction and installation of a municipal electric lighting plant to supply both city and commercial lighting. Bids must be sent to the city engineer not later than April 30.

Tonawanda, N. Y.—There seems likely soon to be an end of the lighting contest that has agitated the people of this city for the last two years, and as between the gas and the electric light company popular feeling is so strong in favor of the latter that it is very probable that the contract for lighting will be secured by the Tonawanda Lighting & Power Company. The voters have already decided against municipal ownership of a plant.

Wapakoneta, O.—The proposition to issue and sell \$5,000 worth of city bonds for improving and enlarging the electric light system was carried at the recent election by a large majority.

Wayne, Neb.—At the election held here recently the proposition to bond the town to secure an electric light plant was carried by a large majority.

Westfield, Mass.—The 1,400 citizens of this town who voted recently for municipal ownership of the gas and electric lighting plant are said to be apologizing to each other for the act. They expected to have to pay about 100,000 for the plant, but the company has filed a statement with the town clerk in which they value the property at \$250,000 and would sell for this sum. The laws require the purchase of existing plants by a town or city before it can go into business for itself.

Wilkesburg, Pa.—The Rural Electric Light Company has asked the council for permission to operate lines for the distribution of electric power throughout the borough.

MANUFACTURING, ETC.

New York.—One of the latest electric elevator contracts awarded the Sprague Electric Company is for ten machines for the Commerce Realty Building in St. Louis. Says a St. Louis contemporary: "This installation represents a distinct advance in St. Louis in modern installations of this character, and its performance will be watched with interest." The St. Louis contract is but one of a large number of out of town contracts recently awarded the Sprague Company.

Indianapolis, Ind.—The Jenney Electric Company has been newly organized with a capital stock of \$50,000. The new company, which is composed of Charles D. Jenney, William C. Hansen, Timothy L. Bosart and John G. Wynn, has purchased the property of the old one and a contract will be let at once for the main building to take the place of the one burned a year ago.

Atlanta, Ga.—W. R. McBride of Chicago states that he has made arrangements for the establishment in this city of a factory for the manufacture of electric lamps and all kinds of electrical supplies which will give employment to from 75 to 100 hands.

TRANSMISSION PLANTS.

Albany, N. Y.—Gov. Black has signed the bill incorporating the Electric Water Power Company of Oneonta, Otsego county, with the right to construct dams on the Susquehanna River for the purpose of developing hydraulic and electric power.

PERSONAL AND MISCELLANEA.

T. M. Steger has resigned the presidency of the Nashville (Tenn.) Street Railway and L. D. Tyson of Knoxville has been elected to the vacancy.

What struck a Fiume, Austria, warehouse and set it on fire turns out to have been a meteor. It was assumed to have been lightning till a four-ton meteoric stone was found in a deep hole in the cellar.

A young man named Warren F. Garis was instantly killed on the 9th inst. in Philadelphia by shock from an electric light wire which he caught hold of while working on a roof at North Second street.

The trolley has driven out the hitching posts in New England towns. There are said to be very few left. Suburban farmers are no longer required to hitch up a horse to take them to town. The trolley cars save them that trouble.

The Governor of Massachusetts on the 14th inst. signed the bill substituting electricity for the rope in putting condemned criminals to death in that State. The new law will not apply to those now under indictment nor to any person who committed murder prior to the act going into effect.

Philip Hess of the Fort Wayne Electric Corporation has received notice of his appointment as electrical engineer of the navy. He was notified, says the Ft. Wayne "Journal," to report at Erie, Pa., for active service on April 15. He will be assigned to one of the new ships recently purchased by the Government.

The Societe Generale des Industries Economiques of Paris has built an electric light installation in the French National Printing Offices free of cost to the Government on condition that they should be paid for the light for thirteen years, the rate to be lower than that formerly paid for gas, and that at the end of the thirteen years the plant shall become the property of the Government.

Thomas H. McLean, vice-president and general manager of the Toledo Traction Company, Toledo, O., has announced a number of changes in the force. Superintendent Hinckley has been succeeded by John Collins, and F. B. Perkins by J. M. Yates. The position of purchasing agent, held by O. E. Merrill, has been abolished. Mr. McLean has abrogated some of the most offensive rules for the guidance of motormen and conductors.

Harry H. Winter, borough auditor and secretary of the Dunmore Electric Light & Heat Company, was instantly killed at Dunmore, Pa., on the evening of the 9th inst. He was notified that an arc light on Chestnut street was not working. He summoned a lineman, who lowered the light, and Winter, standing in the street on the street car track, grabbed the carbon with both hands, the rail completing the circuit. The entire current, 2,800 volts, passed through his body, causing instant death. Winter was 23 years old.

Some of the delicate instruments of the Toronto Magnetic Observatory intended to measure fluctuations in the earth's magnetism have been greatly disturbed by the electric currents flowing through the earth from adjacent trolley lines. Consequently these instruments are to be removed to another site nine miles from the city and two miles from any possible trolley route. The records of the Toronto Magnetic Observatory date back more than half a century and are said to be the most valuable of their kind ever obtained on this continent.

If newspaper reports are true, a Paris physician has made a discovery that will be of undoubted value to electrical men who are so unfortunate as to be burned by the electric current. The Paris doctor says that a solution of one part picric acid and seventy-five parts of water will cure quickly the most serious burns. The pain is instantly removed without blistering or irritation, and the wound heals in four or five days. A yellow tint is left on the skin, which may be removed by a solution of boric acid.

The failure of the firm of Alfred Dolge & Son of Dolgeville, N. Y., has caused deep regret throughout the Mohawk Valley. The failure was immediately brought about by Mr. Dolge's inability, owing to the Cuban difficulty and the uncertainty existing in the money market, to secure the necessary amount with which to meet notes due April 1 and May 1, some of which are already under protest. The liabilities will reach \$1,000,000, and the assets in Dolgeville are estimated as approximating \$1,500,000. Mr. Dolge, the elder, is interested in a number of large enterprises at Dolgeville and neighborhood, one of his latest being the High Falls Electric Light & Power Company, the completion of whose plant was celebrated by an elaborate banquet on the 15th of January last, noticed at the time in this journal.

WANTED FOR THE UNITED STATES NAVY.

Qualified men for the ratings of ELECTRICIAN. Applicants must be capable of performing all duties pertaining to the care, preservation, and manipulation of a ship's electric lighting plant and its appurtenances, together with all other electrical appliances; they must also be physically qualified. First enlistment is made in the rating of Electrician, second class, (\$35 per month,) with possibility of future advancement to Electrician, first class, (\$40 per month,) and Chief Electrician, (\$50 per month). In addition to the pay stated, there is a ration allowance of 30 cents per day. Enlistments in this rating are made only at the Navy Yard, Brooklyn, N. Y.

RECENT COMPANY ELECTIONS.

Consolidated Street Railway Company, Grand Rapids, Mich.—Directors: V. Shaw Kennedy, M. D. Cummings and O. S. Gaither of Chicago; Jacob Kleinhaus and G. Stewart Johnson of Grand Rapids.

Edison Light & Power Company, La Crosse, Wis.—President, F. A. Copeland; secretary and treasurer, E. R. Bentley; directors: Col. F. A. Copeland, J. J. Hogan, E. E. Bentley, R. Y. Hyde, James McCord, A. Hirschheimer, G. Van Steenwyk.

Manchester & Goffstown Electric Railroad Company, Manchester, N. H.—President, Eugene S. Whitney, Manchester; vice-president, F. A. Condon, Goffstown; secretary, Rev. A. W. Sibley, Goffstown; treasurer, Alderman O. D. Knox, Manchester; directors: Dr. C. F. George, George W. Colby, Goffstown; H. H. Simons, Riverdale; H. Pinard, Manchester.

Suburban Street Railway Company, Montgomery, Ala.—President, Alexander Troy; vice-president, Edward A. Graham; secretary, Francis G. Caffey; treasurer and manager, H. S. Jones.

Topeka Street Railway Company, Topeka, Kan.—Directors: M. A. Low, J. N. Monecker, Charles Blood Smith, W. H. Roslington, H. C. Spicer, Charles S. Gleed, P. G. Noel, L. Wason, F. G. Willard, Samuel T. Howe, C. K. Holliday, J. M. Patten, C. C. Baker.

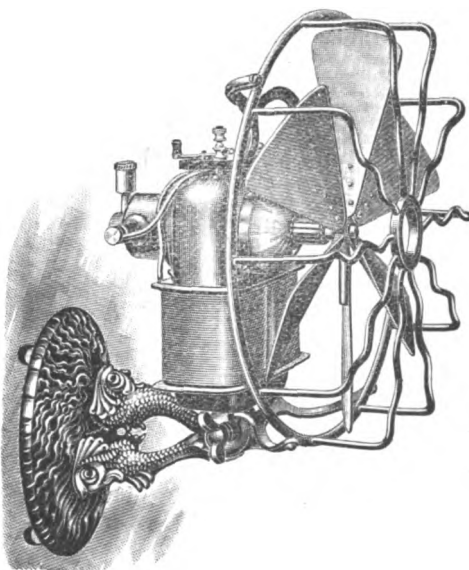
Willow Grove & Hatboro Street Railway Company, Hatboro, Pa.—President, S. J. Garner; vice-president, William Hallowell; secretary, O. E. O. Robinson; treasurer, James Van Horn; directors: James Van Horn, John H. Fow, O. E. O. Robinson, S. J. Garner, William Hallowell, J. F. Cottman and O. F. Ehrenpfort.

COMMERCIAL PARAGRAPHS.

The Noxall Fan Motor.

An exceedingly handsome fan motor now on the market is the 1896 model "Noxall," manufactured by the Vance Electric Company of 136 Liberty street, New York. This fan motor combines art and symmetry, and its design is based on true mechanical principles without the essential element of perfect design being lost sight of. The motor is mounted on a heavy base, thus ensuring rigidity, and at the same time admits of an adjustment of 30 degrees. The motor proper is secured to the base by two dolphins of a grotesque design and of the proper length in order to give the fan and guard the necessary clearance from the base. The two supports admit of and provide ready means of adjusting the inclination of the motor. This adjustment also allows the converting of the fan from a pedestal to a bracket type and vice versa, proper means being provided in the base to secure the fan to the wall. The Vance Electric Company will supply a revolving base for a slight addition in price.

The pole pieces of the motor are of mild steel, all exposed parts being highly polished and nickel-plated. The arma-



NOXALL FAN MOTOR.

ture is of the iron-clad, slotted, Paccinotti type. The commutator is constructed of hard-tempered copper, several features in the same securing long life and reducing the possibility of sparking to a minimum. The bearing case at the commutator end carries the brush holders, the carbons used securing even contact and self-lubrication. The journals are long and self-lubricating, there being enough grease in the cups to last one season. A six-blade fan is used, with extra large spider carefully secured to the shaft by set screws. The guard is heavy and strongly made, and easily removed from the motor frame, if desired. The switch is mounted on hard rubber across the pole pieces, on the top of the machine, and allows of three speeds, namely, 900, 1,400 and 1,800 revolutions per minute. Lower speeds are also supplied, if desired, on special order.

All fans have exposed parts, except base, which is oxidized bronze, nickel-plated, which gives them a very rich appearance. The efficiency of the fans is of the very highest, the following figures showing efficiency of the

various sizes: Twelve-inch fan at maximum speed, 43 watts; 14-inch fan at maximum speed, 70 watts; 16-inch fan at maximum speed, 96 watts.

Educate Your Bowels With Cascarets.

Candy Cathartic, cure constipation forever. 10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

The Warren Alternator.

The General Electric Company have, as is well known, been striving for years to construct an induction machine, but for some unaccountable reason have never seemed to "strike the combination." As long ago as 1892 they illustrated in the *Electrical World* a single-phase double magnetizing coil induction alternator which was heralded in the reading matter columns as the "final triumph." It, too, sank into oblivion and is doubtless resting tranquilly among the other stars once so luminous in the electrical firmament.

The true induction alternator has finally triumphed, as exemplified in the Warren Alternator manufactured by the Warren Electric Manufacturing Company of Sandusky, Ohio.

The greatest possible attention has been paid to the bearings of the Warren Alternator, and it is confidently asserted that the bearings used on this machine have no equal. They have been designed especially for the severe work expected of them in a machine built for practically continuous runs in a service where stoppage from any cause occasions great annoyance and damage, frequently to entire communities. The best bearing heretofore constructed has not met every requirement in the exacting service of electric lighting. In all bearings heretofore made, the slightest wear or derangement due to belt strains, magnetic pulls, centrifugal action, etc., necessitates shutting down and adjusting something. The Warren bearing is self-aligning, self-oiling, but more than all, is adjustable in every direction while the machine is in motion.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

INCORPORATIONS.

The People's Electric Light, Heat & Power Company, Gettysburg, Pa. Capital stock, \$2,000.

The Bidwell Trolley Car Company, Chicago, Ill. Capital stock, \$50,000. Incorporators: Benson Bidwell, Rose Bidwell and Byron Bidwell.

The Decatur Gas & Electric Company, Decatur, Ill. Capital stock, \$400,000. Incorporators: W. C. Jones, G. C. Danforth and Joseph Housum.

The Farnham Electric Company, Chicago, Ill.—to do an electrical manufacturing business. Incorporators: E. W. Farnham, H. Burkholder and G. E. M. Pratt.

The Williams Electric Company, Cleveland, O. Capital stock, \$25,000. Incorporators: J. A. Williams, Will G. Meade, F. J. A. Keller, B. J. Chamberlin and George Gebhard.

The Sayreville Electric Light & Power Company, Sayreville, N. J. Capital stock, \$1,000. Incorporators: Peter Fisher and Edwin A. Fisher of Sayreville, and James R. Sayre, Jr., of Newark, N. J.

The La Salle Electrical Power Company, Buffalo, N. Y.—to deal in real estate, etc., in Erie and Niagara counties. Capital stock, \$50,000. Directors: M. C. Spratt, R. O. Palmer and C. A. Pooley, of Buffalo.

The Point Breeze & Gibson's Point Railroad Company, Philadelphia, Pa. Capital stock, \$18,000. Directors: Malcolm Lloyd, M. W. Harkness, C. E. Bushnell, Edward P. Cooper, H. S. Muston, John W. Lieberton and William D. Cotton, Philadelphia.

The Peekskill Traction Company, Peekskill, N. Y.—to operate a street surface electric road between Peekskill and the towns of Cortland and Yorktown, including also a line to the State Camp. Capital stock, \$150,000. Directors: Charles Mason, James A. Haight, Frank Frye, Charles N. Wells, Jay R. Decatur, Matthew Clune, James F. Martin, Hanford Smith of Peekskill, and Jacob Larssch of New York City.

The E. A. Perkins Electrical Company, Torrington, Conn.—to manufacture electrical engines, supplies, etc., and also to do a general electrical business. President, W.

W. Mertz; secretary, E. C. Franklin; treasurer, E. A. Perkins; directors: George Reynolds, W. W. Mertz, E. A. Perkins and E. C. Franklin.

The Monongahela Street Railway Company, Pittsburg, Pa.—to build and operate an electric railway from the city line on the north side of the Monongahela River, on the Pittsburg & Homestead Bridge, to Schenley Park Bridge, five miles. Capital stock, \$30,000. Incorporators: L. G. Woods, F. M. Ross, C. T. Marsh, C. F. Farren and W. S. Mitchell.

The Chicago, Waukegan & North Shore Railway Company, Chicago, Ill.—to build and operate a railway from a point in the township of Benton, Ill., to a point within the city of Chicago. Capital stock, \$100,000. Incorporators and first board of directors: James H. Van Vliet, John E. Colton, Frank Read, William C. Finroth and Louis F. Nafis, all of Chicago.

The Army Post Electric Street Railway Company, Little Rock, Ark.—to build and operate an electric street railway. Capital stock, \$85,000, of which \$25,000 has been subscribed. Incorporators: Dod G. Gibson and Andrew F. Browne of St. Louis; R. J. Sejourner of Little Rock. The company has purchased the franchise recently secured by Maxwell Coffin and his associates and will construct the line contemplated by the original parties.

The Maryland Electric Railway Company, Baltimore—to construct and maintain a railway in Baltimore City, Baltimore County and Harford County for the transportation of passengers, freight, etc., the cars to be propelled by electricity or any improved motive power other than steam. Capital stock, \$1,000,000, with the privilege to increase to \$3,000,000. Directors: Ex-State Comptroller Marion DeKalb Smith, Henry I. Lohr, Harrison Cassard, Isaac Lobe Strauss and Leopold J. Stern.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 12, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 602,142. Supply System for Electric Railways. Percival J. Pringle, London, England, assignor of one half to Julian Money Vernon Money-Kent, same place. Filed Oct. 27, 1896.
- 602,204. Electric Block System. Franz Burger, Fort Wayne, Ind., assignor of three-fourths to Henry M. Williams, same place. Filed Aug. 2, 1897.
- 601,339. Aerial Railway. Martin A. de Palacio, Madrid, Spain. Filed Dec. 20, 1897.
- 602,281. Track-Welding. Richard Eyre, Johnstown, Pa., assignor to the Johnson Company, Lorain, O. Filed Sept. 22, 1897.
- 602,335. Conductor and Contact Device for Electric Railways. Alvaro S. Krotz, Springfield, O., William P. Allen, Chicago, Ill., and Oliver S. Kelly, Springfield, O. Filed May 28, 1897.
- 602,133. Car-Fender. Frederick A. Harris, Andrew M. Cupples and Michael McCann, Tyrone, Pa. Filed June 26, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 602,303. Manufacture of Reflectors. Sherard O. Cowper-Coles, London, England, assignor to the Reflector Syndicate, Limited, same place. Filed June 10, 1897.
- 602,380. Electric-Arc Lamp. Edgar Weber, Paris, France, assignor to Paul Mersch, same place. Filed Sept. 11, 1897.
- 602,401. Electric-Arc Lamp. John Mueller, Cleveland, O., assignor to the Duplex Hanger Company, same place. Filed Aug. 27, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 602,182. Dynamo for Electric Car-Lighting Systems. Edwin J. Preston and Arthur B. Gill, London, England, assignors to J. Stone & Co., same place. Filed Feb. 25, 1895.
- 602,218. Electric Transformer. Ludwig Gutmann, Pittsburg, Pa. Filed Oct. 31, 1890.
- 602,113. Automatic Device for Removing Resistance in Starting Electric Motors. George H. Whittingham, Baltimore, Md., assignor to the Automatic Switch Company of Baltimore City of Maryland. Filed Sept. 9, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 602,174. Telephone-Transmitter. Herbert E. Shreeve, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Aug. 26, 1897.

BATTERIES.

- 602,172. Secondary Battery. Friedrich W. Schneider, Triberg, Germany, assignor to the Electricitäts-Gesellschaft Triberg, Gesellschaft mit Beschränkter Haftung, same place. Filed June 10, 1897.
- 602,176. Storage Battery. George A. Washburn, Cleveland, O., assignor to the Ohio Storage Battery Company, same place. Filed May 22, 1897.
- 602,302. Suspending Batteries on Carriages. Reginald T. D. Brougham and Walter C. Bersey, London, England, assignors to the Electrical Vehicle Syndicate, Limited, same place. Filed Dec. 13, 1897.
- 602,361. Galvanic Battery. Walter Rowbotham, Birmingham, England. Filed Dec. 16, 1895.

MISCELLANEOUS.

- 602,212. Process of and Apparatus for Electrodepositing. Emile L. Dessolle, Epinay sur Seine, France. Filed Aug. 25, 1897.
- 602,235. Electric-Cord Adjusting Device. Francis N. Lawton, Summit, N. J. Filed April 5, 1897.
- 602,323. System of Electrical Propulsion for Vessels. Jean J. Heilmann, Paris, France. Filed Dec. 3, 1895.
- 602,408. Apparatus for Manufacturing Carbureted Hydrogen. William H. Russell and George E. Russell, Hasbrouck Heights, N. J. Filed Sept. 14, 1897.

The General Electric Company owed on January 1, 1898, \$1,389,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

Newark Express Companies Aid the Monopoly.

The Washington Star comments as follows on the attempt being made in Newark, N. J., by the express companies to aid the Bell monopoly: "In those cities where competing telephone companies have obtained a foothold the branches of the Bell Company have gone to all lengths to crush out the opposition and so preclude, if possible, the chance of a reduction of rates such as usually follows rivalry. In the city of Newark, N. J., a rival company recently obtained such a large number of subscribers by offering low rates and excellent service that the original corporation was driven to the straits of enlisting the sympathetic co-operation of other large concerns. The express companies were brought into the war, and lately notices were served by the agents of the three large express companies in Newark requiring that the instruments maintained by the rival telephone organization be removed forthwith, according to orders from the various headquarters. The merchants of that city are concerned in this move, for it takes from those who subscribe to the rival telephone service the opportunity to communicate speedily with the express offices in the transaction of their business. There is some talk of court proceedings in the name of the patrons of the express companies, but this does not seem to be well founded. The best remedy for the situation is to apply such pressure on the local council or the State Legislature as to create new legal conditions that will force the old company to bring its rates down to the point of reason. It is experience, however, that the devices for crushing out opposition such as the Bell Company has just employed in Newark operate as often to stimulate the rivalry as to check it. The patrons of the telephone service are quick to discern signs of inequality, and if there is a material discrepancy between the two scales of rental prices there can be no permanent postponement of the day when the patronage of the cheaper service will greatly outnumber that of the more costly and will successfully withstand the squeezing processes so frequently invoked by the old corporation."

Three hundred boards of trade and other commercial organizations in every large city in the United States have been asked to take action on an important question, which is tantamount to a demand for a reduction in telegraph rates charged by the Western Union and Postal Telegraph Companies. The movement was started by the Quincy (Ill.) Freight Bureau. Instead of asking that the tolls be lessened, the proposition that will be submitted to the management of the two companies will be to increase the number of words that can be transmitted without extra charge from 10 to 20. The average cost of sending a commercial message anywhere in the United States is 30 cents. Only 10 words can be sent for that sum, additional words being charged for at so much per word, according to the destination of the telegram.

The Mutual Telephone Company of Des Moines, Ia., is getting so many subscribers that it has been forced to increase its switchboard facilities. At present the company has more patronage than it can handle readily, and is making contracts for new connections subject to delay. The Des Moines Leader states that J. W. Hill, H. E. Teachout, M. McFarlin and others interested in the exchange intend to organize a company to build a toll line in connection with the Mutual exchange. It will extend from Des Moines to Ottumwa and will have about thirty-five stations. Ultimately it will be extended north through the central part of the State, making connections with independent exchanges in all the principal cities.

The common council of Norfolk, Va., has decided to grant a franchise in the city to the Southern Bell Telephone & Telegraph Company. The franchise grants the ordinary rights and without any provision with reference to maximum rates, and provides that no poles or fixtures shall be placed in the downtown section of the city. Ten 'phones, free of cost, are to be placed at the disposal of the city; 3 per cent. of the gross earnings are to be paid to the city, and the books of the company shall be subject to inspection. The franchise will be sent to the select council for its approval.

A special from Bristol, Tenn., states that the Bristol Telephone Company expects by next fall to have Bristol in telephonic connection with various points in Tennessee and Virginia. A line will be built to Abingdon, giving connection with Wallace, Wyndale, Emory and Saltville. Later the service will be extended from Gate City to Big Stone Gap, thus connecting with Clinchport, Duffield, Stonega, Norton and Wise, Va.

The board of supervisors of St. Clair County, Ill., have granted franchises to the Pope-Downey Company and the American Telephone & Telegraph Company of Illinois. The Pope-Downey Company may operate a telephone business in the county on certain conditions, one of them

being that they furnish five telephones for use by county officials. The American Company is restricted to telegraph and a long-distance telephone business. If the company should embark in local telephone business, it is to pay the county \$250 a year.

The Canton Co-operative Telephone Company has been organized by the business men of Canton, S. D., with the following officers: President, C. E. Judd; vice-president, M. L. Syverud; secretary, F. H. Bacon; treasurer, C. M. Seely. A local exchange will be put in the city immediately and a line will be run to Moe, Alcester and Beresford. The company secured the franchise for Canton ahead of the Northwestern Telephone Exchange Company.

The Interstate Telephone Company of St. Joseph, Mo., has just completed arrangements to extend its line to Nebraska City, Neb., where the business men have taken \$2,500 worth of the company's stock. The company proposes to extend its line to Omaha, Lincoln and the principal cities in southwestern Nebraska. The rates of the Bell Telephone Company will be cut in half.

The Bell Telephone Company has decided that it will exhibit at the Trans-Mississippi Exposition at Omaha a complete set of instruments showing the first telephone inventions that were used, the gradual improvements made, and the later growth and development of telephone instruments.

A new telephone company is soon to be organized at Stillwater, Minn., an ordinance granting the company a franchise being now before the council. Among the Stillwater people interested in the new venture are Otis Staples, R. H. Bronson and James Mulvey.

The county commissioners of Jefferson county, Col., have granted a franchise to J. D. Babcock, of Golden, to build a telegraph and telephone line in the county, to start at Morrisson and run up Bear Creek canyon to Evergreen.

The council of North East, Pa., refused to grant a franchise to a Bell company by a vote of 5 to 1. The independent company now operating there is giving good satisfaction and its prices are reasonable.

A new telephone company is being organized at Terre Haute, Ind., and it expects to start an exchange there by using a franchise obtained several years ago for a district telegraph service.

The Southwestern Telegraph & Telephone Construction Company is setting the poles for a telephone line connecting Wharton, Tex., with Houston and Victoria.

The council of Atlantic, Ia., has refused to grant the exclusive franchise asked for by the Iowa Mutual Telephone Company.

The new State Telephone Company is constructing a line connecting Oxford and Lapeer, Mich.

New Companies Incorporated.

The Tuscarora Telegraph & Telephone Company, Mifflintown, Pa. Capital stock, \$3,000.

The Long Distance Telephone Company, Chicago. Capital stock, \$2,500. Incorporators: E. C. Cleveland, W. X. Latimer and W. B. Jarvis.

The Standard Telephone Company, Newtown, Bucks County, Pa. Capital stock, \$10,000.

The West Plains Telephone Company, West Plains, Mo. Capital stock, \$20,000. Incorporators: D. W. Reese, Charles H. Gale, F. O. Hines and others.

The Wickwire Telephone Company, Grafton, W. Va. President, Dr. Alex. Leeds; vice-president, Richard Wood; secretary, Z. B. Knotts; general superintendent, Edward Luzatter.

The Atlantic Coast Telephone Company, Atlantic City, N. J. Capital stock, \$100,000. Incorporators: Edwin L. Reinold of Marietta, Pa. Lewis Kuehnle and James B. Reilley of Atlantic City.

American Electric Telephone Company, Chicago. Capital stock, \$100,000. Incorporators: C. C. Buckley, W. D. Latimer and W. B. Jarvis.

The Morrow County Telephone Company, Mt. Gilead, O.—to construct and operate a telephone line from Mt. Gilead to Butler, Richland county, Ohio, with branches extending into Delaware, Marion, Crawford and Knox counties. Capital stock, \$12,000.

The Mutual Telephone Company, Pueblo, Col.—to introduce a mutual telephone system in which the cost of operation will be pro-rated. Capital stock, \$55,000, divided into 1,000 shares. Directors: G. F. Stodghill, John H. Olmes, W. H. Thompson, J. G. Chapman, F. L. Cuddeback, E. E. Hubbell and Francis I. Meston.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Apr. 18:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1% Q., Feb. '98.	145	147½
Troy City Railway Co.	100	2,000,000	1% Q., Dec. 10, '97	70	72
Traction Co. (Saratoga)	100	50,000			
Allentown, Pa.—Apr. 18:					
Allentown & Lehigh Val. Trac. Co.	100	4,000,000	1,500,000		15
Bridgeport, Conn.—Apr. 18:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1% Aug., '97.	45	60
Baltimore, Md.—Apr. 18:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5% S., July 2, '97.	71	72
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000 2% S., Jan. 15, '98	2½	23
Central Ry. Co. of Baltimore City	50	800,000	800,000 6% A. Dec., 1897.	80	82½
Boston, Mass.—Apr. 18:					
New England Street Ry.	25	5,000,000	1,081,925 1% Q., Jan. 15, '97.		
North Shore Traction Co.	100	4,000,000	4,000,000	10	13
North Shore Traction Co.	100	2,000,000	2,000,000 6% S., A. & O.	60	65
West End Street Ry. Co.	50	10,000,000	9,085,000 1% S., Oct., '97.	82	82½
West End Street Ry. Co.	50	6,400,000	6,400,000 4% S., Oct. 1, '97.	102	102½
Boston Elevated R. R.	100	10,000,000		55	57
Brooklyn, N. Y.—Apr. 18:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400 2% Feb. 1, 1898.	185	195
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	37½	37½
Brooklyn Heights Railroad	100	200,000			
Brooklyn City RR.	100	12,000,000	12,000,000 2½% Q., Jan., '98.	199	200
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000		
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000 1% Q., Oct. 1, '97.	185	
Kings County Elevated	100	4,750,000	4,750,000		
Kings County Traction Co.	100	4,500,000	4,500,000 1% July 26, '97	45½	48
Nassau Electric Railroad	100	6,000,000	6,000,000	37½	
Atlantic Avenue Railroad	50	2,000,000	2,000,000		
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000	74	80
Buffalo, N. Y.—Apr. 18:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	58	60
Buffalo Railway Co.	100	6,000,000	5,370,500 1% Q. Dec., '97.	78	80
Columbus, O.—Apr. 18:					
Columbus Street Railroad	100	8,000,000	8,000,000 1% Q., Feb., '98.	47	48
Columbus Central Street Railroad	100	1,500,000	1,500,000		
Charleston, S. C.—Apr. 18:					
Charleston City Ry. Co.	50	100,000	100,000 3% S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000		
Chicago, Ill.—Apr. 18:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 3% Q., Dec. 31, '97.	225	227
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800	10½	11
Lake Street Elevated RR.	100	10,000,000	10,000,000	8½	4
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000		
Met. West Side El. const. st.	100	15,000,000	2,500,000		
North Chicago Street RR.	100	10,000,000	6,600,000 3% Q., Jan., '98.	210	215
North Chicago City RR.	100	500,000	249,900		
South Chicago City Railway	100	2,000,000	1,601,200		
West Chicago St. RR. Co.	100	20,000,000	18,189,000 1½% Q., Feb. '98.	83	91
Chicago West Div. Ry.	100	1,250,000	624,900 35%		
Chicago Passenger Ry.	100	2,000,000	2,000,000 5% S.		
Cincinnati, Ohio.—Apr. 18:					
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000		20
Cincinnati Inc. Plane Ry.	50	150,000	150,000 2½% Feb., '98.		75
Cincinnati, Newport & Gov. St. Ry.	100	4,000,000	8,500,000	23	25
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000 1½% Q., Jan., '98.	112½	113
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1½% Q., Jan., '98.		
Cleveland, Ohio.—Apr. 18:					
Akron, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000 ¾% Jan., '98	39	40
Cleveland City Ry.	100	8,000,000	7,600,000 ¾% Oct., '97.	54	62
Cleveland Electric Ry.	100	12,000,000	12,000,000 ¾% Q., Oct., '97.	50	58
Detroit, Mich.—Apr. 18:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100%	
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000 5% July, '96.	175	
Rapid Railway Co.	100	250,000	250,000		100
Detroit Electric Railway	100	1,000,000	1,000,000		
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton, O.—Apr. 18:					
City Railway Co.	100	1,500,000	1,470,600 1½% Q., Jan. 1, '98.	100	102
City Railway Co.	100	600,000	600,000 1½% Q., Jan. 1, '98	140	145
People's Street Railway	100	1,100,000		100	

PASSENGER RAILWAYS.

NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Hartford, Conn.—Apr. 18:					
Hartford Street Ry. Co.	100	\$1,000,000	\$200,000 8% S., Jan., '98.	140	
Hartford & West Hartford RR.	100	1,000,000	247,000		
Holyoke, Mass.—Apr. 18:					
Holyoke Street Ry. Co.	100	400,000	400,000 8% A., Jan., '98.	200	205
Hoboken, N. J.—Apr. 18:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8%, 1892.	70	
Indianapolis, Ind.—Apr. 18:					
Citizens' Passenger Ry.	100	5,000,000	5,000,000	24	25
Lancaster, Pa.—Apr. 18:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000		
Lancaster & Col. Electric Ry.	100	87,500			
West End Street Railway	100				
Louisville, Ky.—Apr. 18:					
Louisville Ry.	100	4,000,000	3,500,000 1½% Oct., '97.	40	45
Louisville Ry.	100	2,500,000	2,500,000 2½% S., Oct. 1, '97.	90	100
Minneapolis, Minn.—Apr. 18:					
Twin City Rapid Transit	100	17,000,000	15,010,000		
Twin City Rapid Transit	100	8,000,000	1,714,200 1½% Jan., '98.	14	20
Montreal, Canada.—Apr. 18:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8% S., M. & N.	253½	258½
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1½% S., J. & J.	92	94
Memphis, Tenn.—Apr. 18:					
Memphis Street Railway Co.	100	500,000	500,000	15	
New Haven, Conn.—Apr. 18:					
Fair Haven & Westville RR.	25	1,500,000	900,000 1% S., Sept. '97.	60	
New Haven Street Railway Co.	100	1,250,000	1,000,000 2½% A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000		
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—Apr. 18:					
Canal & Claiborne RR. Co.	40	240,000	240,000 4% S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1½% Q., Jan., '98.	123½	126
New Orleans Traction Co.	100	5,000,000	5,000,000	2	8
New Orleans Traction Co.	100	2,500,000	2,500,000	18	15
Crescent City RR.	100	2,000,000	2,000,000 3% S., Jan., '98.		30
New Or. City & Lake RR.	100	2,000,000	2,000,000 4% S., Jan., '98.	81	88
Orleans Railroad	50	500,000	185,000 1½% June, '94.	16	17
St. Charles Street Railway	50	1,000,000	1,000,000 1½% Jan., '98.	58½	54½
New York—Apr. 18:					
Central Crostown RR.	100	600,000	600,000 2½% Q., July, '97.	60	
eChrysler & 10th Sts. RR.	100	650,000	650,000 2% Q., Jan., '98.	160	165
Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000 1½% Q., Feb., '98	175	195
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000 1½% Q., Jan., '98.	137½	177½
eBleecker St. & Fulton Ry. Co.	100	900,000	900,000 4% A., July, '97.	32	34
Brooklyn & Seventh Ave. Ry.	100	2,100,000	2,100,000 2½% Q., Oct., '97.	0	212
Cent. Park N. & E. Rivers RR.	100	1,800,000	1,800,000 2½% Q., Jan., '98.	173	180
Eight Avenue RR.	100	1,000,000	1,000,000	310	325
42d St. & Grand St. Ferry RR.	100	750,000	748,000 4½% Q., Feb., '98.	0	60
Ninth Avenue RR.	100	800,000	800,000	92	114
Sixth Avenue RR.	100	2,000,000	2,000,000	195	210
Twenty-third St. R. R. Co.	100	600,000	600,000 4½% Q., Feb., '98.	10	120
Second Avenue RR.	100	2,500,000	1,862,000 2% Q., Jan., '98.	165	175
Third Avenue RR.	100	12,000,000	10,000,000 2% Q., Feb., '98.	167	170
42d St. Manhat'le & St. Nich. Av.	100	2,500,000	2,500,000	57	62
Union (Huck)berry Ry.	100	2,000,000	2,000,000	175	200
Newark, N. J.—Apr. 18:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	44	44½
Newark Passenger Ry.	100	6,000,000	6,000,000	180	190
Rapid Transit Street Ry.	100	504,000	504,000 11½% A.		
Pittsburg, Pa.—Apr. 18:					
Allegheny Traction Co.	50	500,000	500,000		45
Consolidated Traction Co.	50	15,000,000	15,000,000 2% Jan., '98.	125½	135½
Consolidated Traction Co.	50	15,000,000	15,000,000 3% May, '97.	46½	47½
Central Traction Co.	50	1,500,000	1,500,000		
Allegheny Traction Co.	50	8,000,000	13,000,000 6% A.		
Allegheny Traction Co.	50	8,000,000	13,000,000 6% A.		
Pittsburg Traction Co.	50	2,500,000	1,900,000 3% Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000 2½% Jan., '98.		
Pgh. Allegheny & Man. Trac. Co.	50	8,000,000	12,994,899 2% Aug., '95.		
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000 ½% Aug., '96.	18½	19
Pittsburg & West End Ry.	50	1,500,000	1,500,000 5% A., June 30, '97.		
Second Avenue Traction Co.	50	4,000,000	14,000,000		
Suburban Rapid Transit Co.	50	800,000	200,000		

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h 500 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.
 i 200,000 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k 95% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Crostown Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 f Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%.
 g Leased to Metropolitan Street Railway for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 h Leased to Metropolitan Street Railway for 18% on stock.
 i Leased to Met. St. Ry. for 99 years from April 20, 1892; 8% first 5 years, 8% thereafter.
 j Leased to Metropolitan Street Railway for \$145,000 per annum.
 k Leased to Metropolitan Street Railway for 18% on stock.
 l Controlled by Third Avenue Railroad by purchase.
 m Dividends of 1½% yearly guaranteed by Consolidated Traction Company.
 n Controls by lease the Allegheny, Cent. Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 o Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 p Leased to Fort Pitt Traction Company for 6% on \$8,000,000 capital stock.
 q Leased to Consolidated Traction Company for 4% on capital stock after October.
 r Leased to Consolidated Traction Company for 7% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorized	Issued.						Authorized	Issued.			
New Bedford Mass.—Apr. 18:							Boston, Mass.—Apr. 18:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4% Q. Jan. '98.	...	...
Northampton, Mass.—Apr. 18:							Erie Telegraph & Telephone Co.....	100	...	...	1% Q. Jan. '98.	...	...
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan. '98.	165	175	New England Telephone Co.....	...	10,804,600	10,804,600	\$1.50, Feb. '98.	...	...
Omaha, Neb.—Apr. 11:							New York.—Apr. 18:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co.....	100	14,000,000	14,000,000	1% Q.	...	...
Paterson, N. J.—Apr. 18:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1% Q.	...	...
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	...	...
Providence, R. I.—Apr. 18:							Franklin Tel. Co.....	100	1,000,000	1,000,000	2% guar.	...	...
United Traction & Electric Co.....	100	8,000,000	8,000,000	3% Jan. '98.	59	62	Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q.	...	...
Philadelphia.—Apr. 18:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	...	1% Q. Jan. '98.	...	...
Fairmount Park Trans. Co....\$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14%	...	*International Ocean Tel. Co. guar. 6%	100	8,000,000	...	1% Q.	...	...
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2%, July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	...	1% Q.	...	...
Hestonville, Man. & Fairmount.....	50	588,900	588,900	8% Jan. 10, '98.	61	65	*New York & New Jersey Tel. Co.	100	5,000,000	8,728,000	1% Q. Jan. '98.	...	...
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	8% Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. Co. guar. 4%	100	2,000,000	...	2% Q.	...	...
Union Traction Co.....\$12 1/2 pd.	50	80,000,000	27,930,410	.....	15	16 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	...	...
dElectric Traction Co.....	50	...	8,297,920	.....	71%	71%	*Sout'n & Atlantic Tel. Co. guar. 5%	100	559,525	559,525	2% Q.	...	...
dCitizens' Passenger Ry.....	50	500,000	192,500	\$8 share Q.	307	...	*Commercial Union Telegraph Co.....	25	950,000	800,000	8% S. Jan. 1 '98.	...	...
eFrankford & Southwark Pass. R.	50	...	1,875,000	\$14 share A.—Apr. 97	872	...	Western Union Telegraph Co.....	...	97,870,000	...	1% Jan. '98.	...	...
fLehigh Avenue Ry. Co.....	50	1,000,000	...	A. & O.	47	...	*Div. guar. by Postal Tel. Co.	...	...	...	...	...	...
gLombard & South Street Ry.....	25	...	1,000,000	...	89	90 1/2	Miscellaneous.—Apr. 18:						
hSecond & Third Streets Ry.....	50	1,000,000	771,076	\$9 share A., Mar. 97	265	...	American Dist. Tel. (Phila.).....	25	400,000	...	1% Q. Feb. '98.	14	...
iPeople's Traction Co.....	50	10,000,000	6,000,000	8% A., April, '97.	...	...	Bell Tel. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	172	174
jGermantown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1898.	184	135	Chesapeake & Potomac Tel. Co.....	100	...	...	...	...	...
kGreen & Coates Passenger Ry.....	50	500,000	150,000	8% Jan., 1898.	132	...	Chicago Telephone Co.....	100	...	...	...	...	...
lPeople's Passenger Ry.....com.	25	1,500,000	740,000	...	...	...	Central Dist. Frtg. & Tel. Co. (Fgh.)	100	750,000	750,000	...	...	...
mPeople's Passenger Ry.....pfd.	25	750,000	277,402	...	...	...	Empire & Bay States Tel. Co.....	...	...	...	...	...	...
nPhiladelphia Traction Co.....	50	30,000,000	20,000,000	4% S.—Oct. 1 '97.	7 1/2	79 1/2	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	...	...
oCatherine & Bainbridge St.....	50	400,000	400,000	6% A.—Mar. '97.	...	...	*Northwestern Telephone Co. guar.	80	2,500,000	2,500,000	2% Q.	112	117
pContinental Pass. Ry.....guar.	50	1,000,000	580,000	\$6 share—July, '97.	140	...	Providence (R. I.) Tel. Co.....	50	...	...	...	...	...
qEmpire Passenger Ry. Co.....	50	600,000	600,000	...	...	...	Southern New Eng. Tel. Co.....	100	8,000,000	...	...	...	...
rPhiladelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	176 1/2	180							
sPhiladelphia & Gray's Fy. RR.....	50	1,000,000	298,650	\$8.50 share July '97	86	...	Boston, Mass.—Apr. 18:						
tRidge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share July '97.	...	300	Fort Wayne Electric Co.....	25	...	...	...	...	...
uPhiladelphia & Darby Ry. guar.	50	...	200,000	\$2 share July '97.	...	...	Fort Wayne Elec. Co. T. Sec. Series A.	100	40,000,000	80,460,000	2% Q. Aug. 1898.	81 1/2	82 1/2
v17th & 19th Sts. Pass. Ry. guar.	50	...	250,000	1% S., July, '97.	157 1/2	...	General Electric Co.....com.	100	10,000,000	4,252,000	8% S. July, '98.	80	80
wThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	835,000	\$11 sh. A., July, '97	275	...	General Electric Co.....pfd.	100	10,000,000	4,252,000	8% S. July, '98.	80	80
xUnion Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. July '97	227	228	T.-H. Elec. Co. T. Sec. Series D.	100	...	146,700	...	...	...
yWest Philadelphia Pass. Ry.....	50	750,000	175,000	\$10 share, July '97	225	235	Westinghouse Elec. & Mfg. Co. com.	50	4,000,000	3,996,058	1% Q. Feb. '98.	51 1/2	58
							Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	...	...	...
Rochester, N. Y.—Apr. 18:							New York.—Apr. 18:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	...	118	...
Reading, Pa.—Apr. 18:							*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	8,750,000	1% Q. Oct. '97.	108	108
iReading Traction Co.....	...	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	...	Edison Electric Storage Co.....	100	...	...	...	...	...
kCity Passenger Ry.....	50	850,000	850,000	Jan., '94.	112	...	General Electric Co.....com.	100	40,000,000	80,460,000	2% Q. Aug. 1898.	81 1/2	82 1/2
lEast Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	...	General Electric Co.....pfd.	100	10,000,000	4,252,000	8% S. July, '98.	80	80
St. Louis Mo.—Apr. 18:							Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	...	...	...
Fourth Street & Arsenal Ry.....	50	800,000	150,000	...	...	...	United Elec. Lt. & Pow. Co.....pfd.	...	...	...	...	...	...
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec. 1888.	...	...	Pittsburg, Pa.—Apr. 18:						
Lindell Ry.....	100	2,500,000	2,400,000	1% Jan. '98.	120	122	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	...
National Railway Co.....	...	2,500,000	2,479,000	1% Jan. '98.	...	...	East End Electric Light Co.....	50	800,000	800,000	...	...	10
Cass Avenue & Fair Grounds.....	...	2,500,000	2,500,000	1% Jan. '98.	...	...	Philadelphia, Pa.—Apr. 18:						
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct. '98.	90	110	Edison Electric Light Co.....	100	2,000,000	...	...	144 1/2	...
St. Louis RR.....	100	2,000,000	2,000,000	2% Jan. '98.	95	105	*Electric Storage Battery Co.....com.	100	8,500,000	...	...	20	21 1/2
Missouri RR.....	50	2,400,000	2,300,000	1% Jan. '98.	170	172 1/2	*Electric Storage Battery Co.....pfd.	100	5,000,000	...	...	22	23 1/2
People's RR Co.....	50	1,000,000	900,000	50c. Dec. '89.	...	...	*Penna. Ht. Lt. & Pow. Co.....com.	50	5,000,000	...	50c. p. sh., Oct. '97.	...	...
Southern Electric Ry.....com.	50	500,000	500,000	...	50	52 1/2	*Penna. Ht. Lt. & Pow. Co.....pfd.	50	5,000,000	...	6% Q. Oct. '97.	...	...
Southern Electric Ry.....6% pref.	100	1,000,000	1,000,000	1% Jan. '98.	100	102 1/2	Northern Elec. Light & Power Co..	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	18 1/2	14
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	...	56	57	Southern Elec. Light & Power Co..	10	187,500	187,500	...	10	...
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '98.	...	175	Miscellaneous.—Apr. 18:						
San Francisco, Cal.—Apr.							Brush Electric Co.....	50	...	...	...	...	...
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	...	...	Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	...	...	87	...
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	Edison Ill'g Co. (St. Louis).....	...	...	...	...	...	...
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	53	Eddy Electric Mfg. Co.....	25	...	...	...	...	...
Presidio & Ferries RR.....	100	1,000,000	550,000	...	...	8 1/2	Hartford (Conn.) Elec. Light Co.....	100	850,000	...	...	120	123
Scranton, Pa.—Apr. 18:							Hartford (Conn.) Lt. & Power Co.....	25	175,000	...	...	4 1/2	...
Scranton Railway Co.....	50	6,000,000	2,500,000	...	10	12	New Haven (Conn.) Elec. Lt. Co.....	100	100,000	...	...	148	...
mScranton & Carbondale Trac. Co..	100	500,000	500,000	...	...	18	Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	...	2% Q. Oct. '98.	88	88
nScranton & Pittston Traction Co..	100	1,050,000	1,050,000	...	...	...	Rhode Island Elec. Protec. Co.....	100	...	...	...	115	120
Springfield Ill.—Apr. 18:							Royal Elec. Co. (Montreal).....	...	1,000,000	...	2% Q.	145 1/2	146
Springfield Consolidated Ry.....	100	750,000	750,000	...	...	11	Toronto (Canada) Elec. Light Co.....	100	1,085,000	1,085,000	1% Q.	181	182
Springfield O.—Apr. 18:							Thomson-Houston Welding Co.....	100	...	...	8% S. Dec. 1, '98.	90	100
Springfield Street Ry.....	100	1,000,000	1,000,000	...	...	2	Woonsocket (R. I.) Electric Co.....	100	...	...	...	...	...
Springfield, Mass.—Apr. 18:													
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	206	210							
Toronto Canada.—Apr. 18:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1% S.	92	94	Boston Mass.—Apr. 18:						
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	23 1/2	25 1/2	American Electric Heating Co.....	50	10,000,000	...	...	...	...
Washington, D. C.—Apr. 18:							Street Ry. & Illu'g Properties.....pfd	100	4,500,000	1,248,700	\$8 per sh. Feb. 1, '98	...	...
Belt Ry. Co.....	50	500,000	500,000	...	...	...	United Electric Securities Co.....pfd.	100	...	...	3% Feb. '98.	80	85
Capital Traction Co.....	100	12,000,000	12,000,000	85c. per sh. Oct. '97.	72 1/2	73 1/2	New York.—Apr. 18:						
Columbia Ry. Co.....	50	400,000	400,000	6% A.	72	76	Consolidated Electric Storage Co...	...	...	...	...	...	...
Edgington & Soldiers' Home Ry.....	50	707,000	652,000	...	9	...	Edison European.....	...	...	...	...	19	21
Georgetown & Tenallytown Ry.....	50	200,000	200,000	...	...	...	Safety Car Heating & Lighting Co...	100	...	...	...	88	94
Metropolitan RR. Co.....	50	1,000,000	458,930	2% Q.	116 1/2	120	Worthington Pump Co.....com.	100	5,500,000	5,500,000	...	20	25
Worcester, Mass.—Apr. 18:							Worthington Pump Co.....pfd	100	2,000,000	2,000,000	7%	89	92
*Worcester Traction Co.....com.	100	8,000,000	8,000,000	...	16 1/2	18	Philadelphia, Pa.—Apr. 18:						
*Worcester Traction Co.....6% pfd.	100	2,000,000	2,000,000	3% S., Feb. '98.	93	95	Acetylene L. H. & P. Co.....\$85 pd.	50	1,000,000	...	...	...	...
Wilkesbarre & Suburban Street Ry...	100	550,000	542,500	4% Q., 1897.	85	...	Electro Pneumatic Trans. Co.....	10	1,500,000	...	...	...	...
Wilkesbarre, Pa.—Apr. 18:							United Gas Improvement Co.....scrip.	50	10,000,000	...	...	74 1/2	...
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29	Welsbach Commercial Co.....com.	100	8,500,000	...	...	15	17

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges

BONDS.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—Apr. 18, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co. 1st 5s.	.....	.....	.....	.....	*105¼	106½
†Interest guar. by Albany Ry. Co.						
†Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Apr. 18, 1898.						
Baltimore City Pass. Ry. 1st mtg. 6s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Ext'n. & Imp. 6s.	1,250,000	1,250,000	1901	M. & S.	102½	103
Bal. Trac. Co. No. Balto div. 1st mtg. 6s.	1,750,000	1,750,000	1912	J. & D.	114¼	115
Bal. Trac. Co. Coll. Trust. 1st mtg. 6s.	750,000	.....	1910	J. & J.	101½	.....
Baltimore Traction Co. Convertible 5s.	800,000	.....	1916	N. & M.	103½	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....
Central Pass. Ry. Co. Cons. mtg. 6s.	601,000	580,000	1932	M. & N.	113	116
City & Suburban Ry. 1st mtg. 6s.	8,000,000	8,000,000	1922	J. & D.	113¼	114¼
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1912	M. & S.	110	.....
Metropolitan Ry. (Wash.) 1st mtg. 6s.	1,850,000	1,850,000	1925	F. & A.	117	119½
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.						
†\$151,000 in escrow to retire 1st mtg. bds.						
Boston, Mass.						
Date of Quotation—Apr. 18, 1898.						
Lynn & Boston RR. 1st mtg. 6s.	5,879,000	3,702,000	1924	J. & D.	161¼	105
West End Street Ry. Deben. 6s.	3,000,000	3,000,000	1902	M. & N.	104	.....
West End Street Ry. Deben. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
†\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—Apr. 18, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Apr. 18, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	1017¼	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1906	F. & A.	103¼	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. 6s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104¼	.....
Lake Street Elevated RR. 1st mtg. 6s.	7,571,000	8,781,200	1928	J. & J.	.....	.....
Metrop. W. Side Elev. Ry. 1st mtg. 6s.	15,000,000	15,000,000	1942	F. & A.	48	48
North Chicago St. RR. 1st mtg. 6s.	8,171,000	8,171,000	1906	J. & J.	103½	.....
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	.....
North Chicago City Ry. 1st mtg. 6s.	2,500,000	2,500,000	1927	M. & N.	103	.....
North Chicago City Ry. consol. 4½s.	4,100,000	8,969,000	1928	M. & N.	103	104
West Chicago St. RR. 1st mtg. 5s.	2,700,000	700,000	1911	J. & D.	100	101¼
West Chicago St. RR. Deben. 6s.	12,500,000	6,000,000	1936	.....	90½	91¼
West Chicago St. RR. Cons. mtg. 6s.	1,500,000	1,500,000	1909	F. & A.	102	.....
†W. Chicago St. RR. Tunnel. 1st mtg. 5s.						
†Redeemable at option on 60 da. notice.						
†Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co. lessee.						
†Subject to call after Oct. 1, 1899, at \$110 and interest.						
†Assumed by W. Chi. RR. Co. lessee.						
†Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—Apr. 18, 1898.						
Cin. New. & Cov. St. Ry. 1st Cons. mtg. 6s.	8,000,000	2,500,000	1922	J. & J.	99	101
Eden & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Eden & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Eden & Eden Pk In. Cons. mtg. 5s.	531,700	531,000	1906	M. & S.	.....	108½
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	.....	119
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	129½	.....
†Assumed by the Cin. St. Ry. Co.						
†\$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—Apr. 18, 1898.						
Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1908	M. & S.	106	107
Cin. New & Cov. St. Ry. Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	101¼
Cleveland Electric Ry. Co. 1st mtg. 6s.	8,500,000	1,249,000	1918	M. & S.	105	106
Columbus (O.) Cent. Ry. 1st mtg. 6s.	1,500,000	1,500,000	1918	M. & N.	.....	.....
East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	101½	105
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. 6s.	600,000	.....	1922	M. & N.	.....	.....
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....
St. Ry. Co. Grand Rapids. 1st mtg. 6s.	600,000	600,000	1912	J. & D.	.....	.....
†\$1,900,000 in escrow to retire bonds of absorbed companies, marked a.						
†Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Apr. 18, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,835,000	1905	A. & O.	96¼	99
Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	.....
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
†\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—Apr. 18, 1898.						
New Haven St. Ry. 1st mtg. 6s.	600,000	600,000	919	M. & S.	105	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	.....
Winchester Avenue RR. 1st mtg. 6s.	500,000	500,000	1912	M. & N.	106	.....
Winchester Avenue RR. Deben. 6s.	100,000	94,000	1906	M. & S.	108	.....

*With interest.

*Unlisted.

*With interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—Apr. 11, 1898.						
Canal & Claiborne RR.....1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR.....1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
Crescent City RR.....Cons. mtg. 6s.	5,000,000	8,000,000	1943	J. & J.	75½	77
New Orleans City RR.....1st mtg. 6s.	418,500	399,000	1903	J. & D.	108	111
N. Ori.'s City & Lake RR...1st mtg. 6s.	5,000,000	2,599,500	1943	J. & J.	98¼	99¼
N. Orleans & Carrollton RR. 2d mtg. 6s.	350,000	350,000	1907	F. & A.	110	.....
Orleans Railroad Co.....Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	9½	100
St. Charles St. RR. Co.....1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....
†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
†\$90,000 outstanding.						
New York.						
Date of Quotation—Apr. 18, 1898.						
Atlantic Ave. (Brooklyn)....Imp. 6s.	1,500,000	1,500,000	1934	J. & J.	80	87
Atlantic Av. (Brooklyn)....1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	108
Atlantic Av. (Brooklyn)....Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	105	109
Bro'dway & 7th Ave. 1st cons. mtg. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Bro'dway & 7th Ave.....1st mtg. 5s.	1,500,000	1,500,000	1904	J. & J.	105	107½
Bro'dway & 7th Ave.....2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	.....
Bro'dway Surface.....1st mtg. 5s.	1,125,000	1,125,000	1921	.....	115	117
Bro'dway Surface.....2d mtg. 5s.	1,000,000	1,000,000	1905	.....	106	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown...1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	118	116
*Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	418,000	1933	J. & J.	83	85
Brooklyn Heights RR.....1st mtg. 5s.	250,000	250,000	1911	A. & O.	91	98
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	15	18
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Brooklyn Rapid Transit.....gold 5s.	7,000,000	5,181,000	1915	.....	92½	91
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	103	107
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	113
Central Crostown RR.....1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	100	103
D. Dock, E. Bd'y & Bat'y R. gen. mtg. 6s.	1,000,000	930,000	1922	J. & D.	104	104
Dry Dock, E. Bd'y & Bat'y R. scrip 5s.	1,100,000	1,100,000	1911	F. & A.	100	*103
Eighth Av. RR. Co.....Cert. Indeb. 6s.	1,000,000	1,000,000	1914	F. & A.	104	.....
12d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	116
12d St., Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	81	90
Lex. Ave. & Pav. Ferry RR. 1st mtg. 6s.	5,000,000	5,000,000	1933	M. & S.	113	117
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1897	F. & A.	109½	.....
Second Avenue Ry.....Gen. cons. mtg. 5s.	1,500,000	1,600,000	1920	M. & N.	107½	108½
Second Avenue Ry.....Deb. 5s.			1909	J. & J.	106	.....
Stelway Ferry (L. L.).....1st mtg. 6s.	1,500,000	1,500,000	1922	J. & J.	116	117
South Ferry RR. Co.....1st mtg. 5s.	350,000	350,000	1919	.....	106	111
Third Avenue RR.....1st mtg. 6s.	5,000,000	5,000,000	1937	J. & J.	120	123
Twenty-third Street Ry.....1st mtg. 6s.			1909	J. & J.	103	.....
Twenty-third Street Ry.....Deb. 5s.		150,000	1906	F. & A.	103	104
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111½	114
Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	118	.....
†\$1,085,000 in escrow to retire gen. mtg. bonds.						
†\$4,850,000 in escrow to retire maturing obligations.						
†\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
†In treasury, \$80,000.						
†Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Apr. 18, 1898.						
Montreal St. Ry.....1st mtg. 6s.	2,500,000	800,000	1908	M. & S.	.....	.....
†Toronto St. Ry.....1st mtg. 6s. 4½s.	4,550,000	2,200,000	1921	M. & S.	.....	.....
†\$35,000 per m. single track authorized.						
†\$600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—Apr. 18, 1898.						
Continental Pass. Ry.....1st mtg. 6s.	850,000	310,000	1909	J. & J.	.....	.....
Empire Pass. Ry.....1st mtg. 7s.	800,000	200,000	1900	J. & J.	.....	.....
Greene & Coates St. Ry.....1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....
Lombard & So. St. Pass. Ry.....1st mtg. 6s.	150,000		1901	.....	.....	.....
People's Pass. Ry.....1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
People's Pass. Ry.....2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....
People's Pass. Ry.....Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	.....	.....
People's Pass. Ry.....Stk. cert. 6s. 4s.	5,698,210		1913	.....	101½	101½
Phila. City Passenger Ry.....1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....
Philadelphia Trac. Co.....Coll. tr. 6s.	1,300,000	1,018,000	1917	F. & A.	104	105
Thirteenth & 15th St. Ry.....1st mtg. 7s.	100,000	100,000	1903	A. & O.	.....	.....
Union Passenger Ry.....1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....
†Union Traction Co.....Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	.....	.....
West End Passenger Ry.....1st mtg. 7s.	.....	.....	1905	.....	.....	.....
West Phila. Pass. Ry.....1st mtg. 6s.	250,000	246,000	1906	A. & O.	115½	.....
West. Phila. Pass. Ry.....2d mtg. 5s.	750,000	750,000	1926	M. & N.	114½	115
‡ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Apr. 18, 1898.						
Birmingham, Knox & Allentown.....6s.	500,000	500,060	1931	M. & S.	88	90
Central Traction Co.....1st mtg. 5s.	875,000	875,000	1930	J. & J.	.....	.....
Citizens' Traction Co.....1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....
*Duquesne Traction Co.....1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	.....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	.....	.....
Fed'l St. & Pleasant Valley.....Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	.....	.....
Millvale, Etna & Sharpsburg.....5s.	750,000	750,000	1923	M. & N.	105	.....
Pittsburg, Crafton & Mansfield.....5s.	250,000	250,000	1924	J. & J.	.....	.....
Pittsburg Traction Co.....1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	.....
Pittsburg & Birmingham.....1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	104	105
Pittsburg & West End.....1st mtg. 5s.	500,000	500,000	1922	J. & J.	.....	.....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	.....	.....
Second Ave. Traction Co.....1st mtg. 5s.	2,500,000	2,000,000	1934	J. & D.	.....	.....
Sub. Rapid Transit Railway Co.....6s.	500,000	500,000	1913	M. & S.	.....	.....
Providence R. I.						
Date of Quotation—Apr. 18, 1898.						
Newport Street Ry.....Coupon 5s	50,000		1910	J. & D.	.....	.....
United Trac. & Elec. Co.....1st mtg. 6s	9,000,000	8,247,000	1938	M. & S.	104	106
St. Louis.						
Date of Quotation—Apr. 18, 1898.						
†Baden & St. Louis RR.....1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	102
Cass Ave. & Fair Gds. Ry.....1st mtg. 6s.	2,000,000	1,901,000	1912	J. & J.	107½	108½
†Citizens' Railway Co.....1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107½	108½
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	110½	112½

PASSENGER RAILWAY.

NOTES FOR INVESTORS.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Apr 18, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	100½	107½
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	117
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. 6s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	300,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	111½	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$400,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Apr., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR.1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	127	120½
†Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
†Omni-bus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	109½	110
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Apr. 18, 1898.						
Belt Ry. Co.....U. S. mtg 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....' ' mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home.....mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Apr. 18, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	103
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,513,000	1931	F. & A.	110	112
†Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	108	109
†Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	100½	101
†Crosstown St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
†No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
†No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	489,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
†Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	101	102½
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$47,000 in treasury.						
†\$960,000 res'd to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
<i>Date of Quotation—Apr. 18, 1898.</i>						
Fidison Elec. Illuminating Co., Boston....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	100 1/4	.....
Pittsburg, Pa.						
<i>Date of Quotation—Apr. 18, 1898.</i>						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Apr. 18, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s...	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 6s.	15,000,000	2,160,000	1933	.....	114 1/2	.....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1923	F. & A.	60	61
M. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
M. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
<i>Date of Quotation—Apr. 18, 1898.</i>						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100 1/2	104
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108 1/2	.....

ALLIED INDUSTRIES.

Miscellaneous.						
<i>Date of Quotation—Apr. 18, 1898.</i>						
American Electric Heating Co. 6s.	500,000	500,000	.....	.....	.15	.19
Armstrong & Sims Eng. Co. 10s.	.....	.....	.....	.....	.....	25
*Barnes & Smith Car Co. 10s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	.....	.....
Washington Pump Co. 6s.	71,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

Late quotations for copper are: Electrolytic, 11 1/2c.; Lake, 12c.; casting, 11 1/2c.

The Consolidated Traction Co. of Pittsburg, has declared a dividend of \$1.59, payable May 5.

A dividend of 1 per cent., payable May 2, was declared on the 18th inst. by the directors of the Columbus (O.) Street Railway Company.

Among the securities listed at the New York Stock Exchange last week was Union Elevated Railroad Company of Chicago—\$5,000,000 capital stock.

The annual stockholders' meeting of the New England Telephone & Telegraph Company will be held May 3 in New York. Books closed April 1 will reopen May 3.

The directors of the Springfield (Mass.) Street Railway Company have voted to ask the Railroad Commissioners for permission to increase the capital stock of the road by \$300,000.

The board of directors of the Sprague Electric Company of New York have declared a dividend of 3 per cent. on the preferred stock, payable on May 2 to shareholders of record on the 18th inst.

The Massachusetts Railroad Commissioners have approved an issue of \$50,000 additional stock to the Globe Street Railway Company of Fall River for the exchange of 500 shares of the Fall River Street Railway Company.

The bill to give the Gas and Electric Light Commission supervisory powers over telephone companies in Massachusetts was defeated in the House by a vote of 84 to 77, and by a heavier vote on the 13th inst. it refused to reconsider.

The Municipal Assembly of St. Louis has passed the franchise granted to the Central Traction Company over the mayor's veto. It is announced that application will be made for a writ of quo warranto to vacate the franchise.

A Philadelphia press special says: "Traction interests throughout the country continue to show gratifying gains in earnings. Such gains are very welcome to Philadelphia financial interests which have been pioneers in nearly all leading street railway systems in the country outside of Boston."

Two deeds have been filed in the Register of Deeds office, Kalamazoo, Mich., conveying all the property, equipments and franchises of the Citizens' Street Railway Company to the Michigan Traction Company. The Michigan Traction Company assumes the \$60,000 bonded indebtedness of the old company.

The Private Bills Committee of the Ottawa (Can.) Legislature has passed the bill increasing the capital stock of the Hamilton and Lake Erie Power Company from \$1,000,000 to \$3,000,000. The power is to be obtained from the Welland river to furnish power and light to Hamilton, Brantford and others places in Canada.

The directors of the North Chicago Street Railroad have decided to issue \$1,320,000 stock, increasing the amount outstanding from \$6,600,000 to \$7,920,000. The total authorized stock issue is \$10,000,000. This additional stock will be offered at par to stockholders of record April 25th. It will be used to retire outstanding certificates of indebtedness.

Oscar Johnson of Corona, N. Y., got a verdict of \$20,000 against the Brooklyn Heights Railroad Company in the Supreme Court in Long Island City on the 17th inst. He sued for \$25,000 because of injuries received on January 8, 1897, when a wagon which he was driving was run into by a trolley car and he received injuries which will make him a cripple for life.

The proposed route for a street railway between Elizabeth and Plainfield, N. J., is being surveyed and property lines secured. The franchise will be advertised and sold to the highest bidder at an early date. The offer of \$100,000 by John Kean is the first on the list. It is believed that the bids will reach \$200,000. The route will be twelve miles long and will parallel the Central Railroad tracks.

A dispatch from New Haven to the New York "Commercial" intimates that the Consolidated Road has under consideration a plan to equip the railroad between the cities of New Haven and Derby with electricity. The road is about ten miles long and connects Ansonia, Derby and Shelton with New Haven.

The directors of the Albany Railway, Albany, N. Y., at their monthly meeting on the 15th inst., elected William J. Walker, of the firm of Walker & Gibson, a director in the place of J. Irving Wendell. The directors at the same meeting declared the regular quarterly dividend of 1 1/2 per cent., payable May 2. Books close on April 21 and reopen May 3.

At Detroit, Mich., on the 12th inst. Circuit Court Commissioner Hurst sold twenty bonds of the Detroit Motor Company under an order of the Supreme Court. The bonds were bid in by J. Hudson, receiver of the Third National Bank, at 30 cents on the dollar. There were also sold 20 interest coupons of other bonds, which brought \$180. These were all held as security for some notes at the time Mr. Hudson was appointed receiver of the bank.

It is understood in Philadelphia that the owners of the Northern, West End and Southern Electric Light companies, the only remaining independent companies in that city since the Pennsylvania Heat, Light & Power Company consolidation, have agreed to go into the consolidation. They will form part of the Pennsylvania Manufacturing, Light & Power Company, which has taken over the consolidated company. The terms are said to be favorable. Holders of the Northern were offered, it is stated, \$16 cash or \$12 in the Hamilton Company bonds and 25 shares of Hamilton stock at \$1. The Hamilton Company was one that went in under the former consolidation. The Northern is in some respects the most important of the three companies named.

Gov. Black has signed Assemblyman Eldridge's bill extending from ten to fifteen years the time within which certain railroads must complete their roads. The bill apparently applies only to the South Brooklyn Railroad & Terminal Company, of which John W. Ambrose is president, W. Bayard Cutting treasurer, and Francis H. Bergen secretary, all of New York City. The company has built that part of its road, about a mile long, running from New York Bay at foot of Thirty-eighth street to Ninth avenue, which is operated by the Brooklyn, Bath & West End Railroad Company, which in turn is operated by the Nassau Electric road in Brooklyn. The South Brooklyn Company also has the right to construct about eight miles of road through the former towns of New Utrecht, Flatbush, Flatlands and the Twenty-sixth Ward of Brooklyn to the westerly line of Jamaica. The time within which this part of its road should be completed has expired, and under this bill is extended.

The Kings County Traction Company of Brooklyn went out of existence on the 11th inst. by a unanimous vote of its stockholders that it be dissolved. Its assets will be sold and the proceeds will be divided among the stockholders. The company five years ago organized and purchased on a capitalization of \$4,500,000 the property of the Brooklyn Traction Company, which consisted of the capital stocks of the Atlantic Avenue and Brooklyn, Bath & West End Railroads. These roads were in April, 1896, leased to the Nassau Electric Railroad Company for 99 years for \$150,000 annually, to 1898, and \$180,000 thereafter, all charges to be paid and \$500,000 improvements to be made by the lessee. The Kings County Traction Company had since then received the rents and distributed them among the stockholders, and saw that the conditions of the lease were carried out. This accomplished, it was, in the wisdom of the board of directors, expedient to dissolve the corporation.

ELECTRICITY.

Vol. XIV.

NEW YORK, APRIL 27, 1898.

No. 16.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.00
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	241-242
An Electrically Propelled Cruiser.	
Early Application of Electricity to Submarine Mines.	
Conference of the Union for the Protection of Industrial Property.	
Under the Searchlight,	242
We Told You So.	
Electric Lighting in Cuba.	
Omitted the Dynamo.	
New Electric Incandescent Lamps.	
American Institute of Electrical Engineers,	243
Demonstrating the Use of Submarine Mines,	243
The Electricity Supply of London,	243
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XVIII—Antimony, Chromium, Magnesium and Nickel. By J. B. C. Kershaw, F. I. C.,	244
Some Recent Improvements in Accumulators and their Application to Traction on Common Roads. By J. T. Niblett,	245
Wireless Telegraphy. By W. J. Clarke. (Discussion, concluded),	247
The Kingsland System of Electric Traction,	248
New Method of Measuring the Intensity of Magnetic Fields. By E. Bouty,	248
London Notes,	249
Electrical Exhibition Notes,	249
Electric Railway Projects Abroad,	250
Legal Notes,	250
The News,	250
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous,	251
Recent Company Elections,	251
Commercial Paragraphs,	251
Incorporations,	251
Electrical Patent Record,	252
Telephone and Telegraph,	252
Electrical Securities—Stocks, Bonds, Etc.,	253
Notes for Investors,	256

EDITORIAL NOTES.

An Electrically Propelled Cruiser.

The Navy Department is said to have under consideration plans for a cruiser which, so far as speed is concerned, it is thought will outclass anything afloat. The inventor of this new form of vessel, Mr. Richard B. Painton, claims that by the aid of electricity he will be able to propel such a cruiser at the rate of forty knots an hour. The general details of this invention have as yet not been made public, but it is known that electricity will be the motive power, and instead of using a triple screw, as is now customary, Mr. Painton proposes to employ anywhere from ten to sixteen independent propellers. Moreover, the plans which are now in the hands of the Navy Department call for a cruiser about 600 feet in length. In an ordinary vessel of the above dimension the propeller shafts would necessarily be in the neighborhood of 300 feet long, and consequently the vibration something terrible, to say nothing of the possibility of a break occurring, as frequently happens in the case of ocean liners. With a view to overcoming this objection, Mr. Painton proposes to use exceedingly short lengths of shafting, independently operated, so that in the event of one or more becoming disabled through any mishap there would still be a sufficient number of propellers in working order to drive the vessel through the water at a moderate rate of speed.

It is to be regretted that the details of the electrical machinery by means of which the inventor proposes to obtain such high speed has not been made public.

Up to the present, electricity has scarcely been thought suitable as the principal motive or propelling power for the larger type of vessels. This is undoubtedly owing to the fact that for a given horse power a triple or quadruple expansion steam engine would take up less space, and probably weigh less than an electrical installation of equal power. Storage batteries are out of the question for such uses, although persons not well up in electrical subjects frequently wonder why our ocean grayhounds are not propelled by some such method. It may interest some of our readers to know that a vessel requiring an average of 10,000 horse power to propel it across the Atlantic would be obliged to carry, were storage batteries alone made use of, 324,480,000 pounds of such batteries, or in other words, the motive power alone would weigh 162,240 tons. The storage battery unquestionably has its sphere of usefulness, as for instance in regulating the pressure in central stations during fluctuations in the load, or as a means of meeting sudden extra demands for current which might unexpectedly

arise, but as a propelling power for the larger class of vessels at the present state of the art the storage battery is prohibitory. A detailed description of Mr. Painton's electrical equipment will therefore be looked for with interest.

* * *

Early Applications of Electricity to Submarine Mines.

At the present time when electrically-operated submarine mines and torpedoes have reached a high state of perfection, it may interest our readers to know that probably the first instance of a submarine mine being exploded by the aid of electricity occurred on the Potomac some fifty-six years ago. As Robert Fulton was undoubtedly one of the first, if not the first, to improve the torpedo then in use, so Samuel Colt, the inventor of the well-known revolver, was the first to make use of an electric battery in firing a mine located under water. In the summer of 1842 the United States Government was prevailed upon to place an old schooner at Mr. Colt's disposal to be experimented upon on the Potomac. In the presence of a large number of high Government officials, among whom was General Winfield Scott, Mr. Colt successfully destroyed the schooner by means of a current of electricity from an observation tower located on the bank of the Potomac, a distance of five miles from the mine. In those early days of electricity, this feat was considered something unparalleled, and attracted considerable attention in scientific circles both in this country and abroad. After the successful completion of the test, the inventor asserted that he could explode a shell under water by practically the same methods at a considerably greater distance. With a view to enabling him to carry on his experiments, and perfect his apparatus, President Taylor, who took great interest in such matters, caused an appropriation of \$17,000 to be made to Mr. Colt, with the understanding that a more extensive trial of the invention should take place at an early date. On October 18, 1842, therefore, a well-arranged mine was electrically fired by Mr. Colt in New York harbor, with equal success, in the presence of a large gathering of people. The *Evening Post* of October 19, 1842, described this interesting event as follows: "A vast multitude assembled yesterday afternoon to witness the explosion of Colt's submarine battery placed under a vessel of 260 tons. The North Carolina, seventy-four, about 4 o'clock gave a salute of thirteen guns. Immediately afterwards the signal for the explosion was given. The vessel rose bodily out of the water and then separated into fragments which were thrown about 70 feet into the air. The next moment nothing was seen of her except a few pieces of the wreck which were floating

on the water and of which the boats lying near hastened to possess themselves. The Secretary of War was present in Castle Garden."

* * *

Conference of the Union for the Protection of Industrial Property.

The Patent Office in Washington has received through the State Department a full report of the Conference of the Union for the Protection of Industrial Property which was held at Brussels in December of last year. The report was prepared by Hon. Bellamy Storer, Minister to Belgium, and Mr. Francois Forbes, the United States delegates to the conference, and is of marked interest. There were present at the conference not only delegates from fifteen of the states of the union, but delegates also from seven states which have not as yet joined the union, among them being Germany and Japan. From the active interest which these delegates took in the proceedings, it is evident that the aims of the union are universally recognized as of the highest importance.

Propositions for amendment of the convention, submitted by the United States, looking toward reciprocity in the matter of fees and the requirement of working and the matter of invention belonging to certain classes which are patentable in the United States but not in various other countries, were held by the conference to be contrary to the general spirit of the convention, but several solutions of the difficulties complained of were suggested which would not be obnoxious to the convention, such as requiring of any inventor who has applied for a patent in a foreign country before applying in the United States, first, the payment of the same fees in the United States as are required in the foreign country in which application was made; second, the limitation of the patent granted in the United States to the invention protected by the foreign patent, and third, providing that the patent granted in the United States be within the time within which working is required in the foreign country.

As the fees exacted in many foreign countries for the grant and annual taxes on patents, and the requirements of working the invention in each country in which it is patented are extremely onerous upon our inventors and manufacturers, it is believed to be but right that foreign inventors who take out patents here should not be permitted to obtain these patents under easier conditions than they can in their own countries.

The proposition submitted by the United States for the purpose of removing any question as to the effect upon the right of priority of the amendment of an application found necessary in the progress of the examination into the novelty of the invention was favorably received, but was not incorporated into the convention for the reason that it was believed unnecessary, it being the opinion of the conference that it was "incontestable that the restrictions given to the original description during the preliminary examination cannot prejudice the right of priority established by Article 4." This is of importance, as it had been generally understood that a United States inventor seeking to secure the benefits of the "delay of priority" of seven months under the convention must file in the foreign countries the application as originally filed here instead of the application in the amended form in which it became a patent. Under the present understanding of the convention, the United States inventor having filed his application here may at once offer his invention for sale in a foreign country or otherwise bring it to the notice of manufacturers there, and yet on making application at any time within seven months from the date of his application here obtain there a valid patent.

A proposition to so amend the convention that patents granted in the several countries shall be mutually independent, that is, that a patent granted

for fourteen years in one country shall not shorten the term of a patent subsequently granted in another country in which the normal term is seventeen or twenty years, received the support of the United States delegates and was adopted by the conference.

The proposed extension of the "delay of priority" to one year, the proposition that patents worked to the extent required in the country of origin should not be forfeited for non-working in other countries for at least three years from the grant of the patent, and certain propositions relating to trademarks, were discussed very fully, but had to be left to be settled by correspondence.

With the report is a statement of the inventions excluded from protection in a number of foreign countries, and a statement of the requirements as to working the invention exacted in certain other countries. In some countries the failure to manufacture the invention in the country within one year invalidates a patent granted on the invention. In others two years, or even three years, are allowed, and importation of goods made under the patent is prohibited. This means that the manufacturer of an American invention must establish factories in each of these countries or give up patent protection in them, which, as can readily be seen, is a very onerous requirement.

In relation to the matter above referred to, Representative Hicks, chairman of the House Committee on Patents, has introduced a bill authorizing the President to appoint three commissioners whose duty it shall be to revise and amend the laws of the United States concerning patents, trade and other marks, and trade or commercial names, which shall be in force at the time such commission shall make its final report, so far as the same relate to matters contained in or affected by the convention for the protection of industrial property concluded at Paris, March 20, 1883, the agreements under said convention concluded at Madrid, April 14, 1891, and the protocols adopted by the conference held under such convention at Brussels, 1897, and the treaties of the United States and the laws of other nations relating to patents, trade and other marks, and trade or commercial names. The commission is to report to Congress at once, and the report shall be so made as to indicate any proposed change in the substance of existing law, and shall be accompanied by notes which shall briefly and clearly state the reasons for any proposed change. The report shall also be accompanied by references to such treaties and foreign laws relating to patents, trade and other marks, and trade or commercial names, as in the opinion of the commission may affect citizens of the United States. The work of this commission should interest every inventor and manufacturer in the United States.

Under the Searchlight.

Notes and Comments on Various Topics.

MR. WILLARD E. CASE, vice-president of the New York Electrical Society, has addressed a letter to Prof. F. B. Crocker of Columbia University which is worthy of prompt consideration. The letter is as follows:

In view of the fact that the efficiency of electrical lighting equipments on land and sea will form a vital factor in the present war, I would submit to you as the representative of the Electrical Department of Columbia University and as a member of the council of the American Institute of Electrical Engineers, the following suggestion: That the professional and skilled electricians of our universities, colleges and electrical societies shall form themselves into a body which shall supplement the electrical corps engaged in active work on the water and in the field, to be available to the Government for expert advice in all matters relating to the utilization of electricity in naval and military operations, thus adding to the present regular expert electrical resources of the Government.

* * *

It is stated that an Electrical Trust is now being formed at Geneva, Switzerland, backed by German

and English capitalists. Let us hope this new combination will be run on principles very different from those of our own Electric Trust.

* * *

We Told You So.

In our April 6 issue we published the following under the heading of "War on General Electric":

"A leading official of the General Electric Company says: 'It is true that we have received some contracts from the Government for special work, but the amount of money involved does not begin to compensate us for the loss of contracts which we undoubtedly would have received if there were no disturbance to general business from the Cuba trouble. Where we get one contract from the Government I may say we lose ten from syndicates which were contemplating new work of various kinds.'—Boston News Bureau.

"If the rumor of war is affecting the business of the General Electric Company, as the above statement leads one to believe, the holders of the preferred and common stock will be obliged to gird up their loins for another long and patient wait if war actually breaks out. Such an event would make an excellent excuse for postponing the rumored settlement indefinitely."

The New York Commercial of April 22 now says:

The stockholders of the General Electric Company will hold their annual meeting in Schenectady on May 10. Transfer books closed April 13 and will reopen May 11. It is reported that the plan for financing the accrued dividends on the company's preferred stock would be laid aside for the present and not come up at the meeting.

The above bears us out in our statement of April 6, and, as we correctly prophesied, another long wait would seem to be in order. What a fortunate thing it is—for some people—that war broke out!

* * *

ELECTRIC fountains are no longer the exclusive features of summer parks and summer resorts, but the public are to be treated to their beautiful effects in the everyday walks of life. Paris has taken the initiative and is installing electric fountains in several of the most frequented parks, says the *Pittsburg Dispatch*. The fine fountains in the Place de la Concorde and those which mark the entrance to the Avenue de l'Opera, Place du Theatre Francaise have just been fitted with lamps transforming them into luminous fountains. The latest trials have shown that it is sufficient for good results to put in the bottom of the fountains water-tight boxes with glazed openings containing from 1,500 to 2,000 candle-power of incandescent lamps, the light from which is converged and thrown upward by lenses. The glass covers are colored lightly with a golden yellow. The result given is said to resemble a cascade of diamonds and topazes lit by the summer sun.

* * *

THE following notice has been posted in the General Electric Works in Schenectady. It will be noticed that it is more guarded in its promises than in its grammatical construction:

If employees of the company are called by the Government for service it will be the intention and desire of the company to re-employ them at the expiration of their term of Government service if they shall not then be incapacitated for duty.

* * *

New Electric Incandescent Lamp.

The following is an extract from a letter of Dr. Johannes Horowitz, from Vienna, in the *N. Y. Times*:

Another great success appears likely to be scored by the inventive spirit which of late years has been busying itself with the discovery and utilization of new sources of light. In learned circles in Berlin almost a year ago it was reported that a Goettingen professor had succeeded in producing incandescent light in an entirely new manner. Further details of this discovery made by Prof. Nernst have come to hand, and he is said to have sold his rights to Messrs. Siemens & Halske for 5,000,000 marks. In his new lamp the professor uses, not a thin carbon thread which is made to glow in a globular glass vessel, as has always been the case with glow lamps hitherto, but so-called "bad conductors," such as magnesium, lime, zircon, etc. These bodies will bear very high temperatures without melting; but heat greatly increases their conductive power. Prof. Nernst's invention is based on these quali-

ties. The incandescent body is a hollow cylinder about 8 millimeters long and 1 millimeter broad, consisting of burned magnesium, which is connected with an alternating current of low voltage that causes it to emit light. This new lamp is said to produce far more light in proportion to the consumption of electricity than do the lamps now in use. With the Nernst lamp one watt suffices to produce a light of 1.04 candle power, whereas with an ordinary incandescent lamp one watt produces only 0.40 candle power.

* * *

Electric Lighting in Cuba.

From all accounts the electric lighting and gas companies have been among the worst sufferers in Cuba. The Spanish Government is conducting its operations almost entirely on credit, and as a result money is very scarce throughout the island. In the cities the gas companies and the electric light companies can collect nothing. If they press for payment, their plants are threatened by the Government with confiscation.

* * *

Omitted the Dynamo.

The Columbus, O., *Journal* is responsible for the following rather remarkable statement:

Bids for equipping the new municipal electric light plant were opened by Secretary Fanning of the board of public works Wednesday afternoon. There were 23 of them, for various portions of the machinery. Most of the interested companies were represented. There were bids for boilers, engines, poles, wire and everything else that goes to make up the equipment of an electric light plant but the one thing more important than all—the dynamo.

Mayor Black and Director of Public Improvements Jacobs were not a little surprised when no bids for a dynamo were received. And the bidders for the rest of the equipment were, or professed to be, at a loss to account for it. There were representatives of several electrical manufacturing companies present during the opening of the bids, but they remained on the fringe of the crowd and were merely onlookers.

The city administration thinks the reason no bids for a dynamo were received is because the electrical companies have combined and entered into a conspiracy to prevent the equipment of the plant and the inauguration of municipal electric lighting in Columbus. But, however this may be, the administration does not intend to be balked in the consummation of the project. An advertisement for bids for a dynamo will in all probability be published, and then in the event there is no response, the purchase will be made through other channels, of which the electric combine, if there is really such a thing, will be in ignorance.

American Institute of Electrical Engineers.

The 124th meeting of the Institute will be held at 12 West 31st street, New York City, on Wednesday, April 27, at 8 o'clock P. M.

A paper will be presented by Prof. W. E. Goldsborough of Lafayette, Ind., entitled "An Economy Test of a Central Station." Also a paper by Charles J. Reed of Philadelphia, Pa., on "A Novel Form of Thermo-Electric Battery." This paper will be accompanied by experiments with the apparatus described.

Applications have been received from the following candidates for associate membership, and will be acted upon by Council at its meeting May 17, 1898: Felix L. Cadon, Washington, Ind.; Johnston Livingston, Jr., Islip, N. Y.; Thomas Dempster, Schenectady, N. Y.; Wallace R. Turnbull, East Orange, N. J.; D. B. Heilman, Reading, Pa.; James H. Winfield, New Glasgow, N. Y.; Fred. W. Wood, Los Angeles, Cal.; Howard Joslyn, Seattle, Wash.; Irving A. Taylor, Brooklyn, N. Y.; Paul Lethenle, Schenectady, N. Y.; J. J. Mahony, New York.

Members who desire to present papers for the General Meeting, Omaha, Neb., June 27-29, are requested to communicate with Mr. Herbert Laws Webb, 15 Dey street, chairman of the Committee on Papers and Meetings, or with Secretary Ralph W. Pope.

Demonstrating the Use of Submarine Mines.

Mayor H. J. Smith, of Pompton, N. J., one of the best known experts in the world in submarine explosives, mines, etc., has very kindly tendered his services to the Electrical Exhibition management

for the demonstration in a special tank of the manner in which harbors are protected, ships blown up, etc., and some of his ingenious apparatus has been loaned for this interesting work by Mr. C. McLaughlin, of J. H. Bunnell & Co. This will probably be one of the most attractive features of the show.

Personal.

Mr. W. F. Osborne, who is well known in the electrical field as the Eastern manager of the *Western Electrician*, announces that on May 1 he will sever his connection with that publication to accept the position of business manager with the *National Provisioner*, a leading weekly newspaper devoted to the large packing, refrigerating, cotton-seed oil manufacturing and tannery interests of the country. We heartily wish Mr. Osborne success in his new undertaking.

THE ELECTRICITY SUPPLY OF LONDON.

Before the Institute of Civil Engineers, London, on April 5, a paper was read by Mr. Arthur H. Preece, of which the following is an abstract:

The supply of electricity on a commercial scale had been started in London after the passing of the Act of Parliament in 1888 which amended the Act of 1882, principally by extending the date for compulsory sale to the local authority from 21 years to 42 years. In 1888 many companies applied for Provisional Orders, and, in determining which were to be granted powers, and the districts over which the powers were to extend, the Board of Trade decided that competition would be advantageous to the public, and that it was advisable to allow one direct-current system to compete with one alternating-current system.

There were now in London eleven important companies and five Vestries supplying electricity, and three other companies and three Vestries were taking steps to start works. The capital invested in the industry amounted to £6,000,000, and plant was installed to the extent of 80,000 HP., the equivalent of 2,000,000 8 CP. lamps being connected to the mains. The total annual revenue was £800,000 and the total annual expenditure £450,000.

Of the systems for supplying electricity in London, the alternating current was applicable to large areas where consumers were scattered, and it enabled the generating works to be established by the riverside, or where land was cheap and coal was easily unloaded. The undertakings using this system were the City of London Company, the Metropolitan Company, the London Electric Corporation, the County of London Company, House to House Company, Hampstead Vestry, Islington Vestry and Hammersmith Vestry. The direct-current systems were divisible into two classes, the high pressure and the low-pressure. In the former rotary transformers were used to reduce the high pressure to a low pressure, while the latter produced and distributed electricity at the same pressure at which it was supplied to consumers. The direct-current systems were applicable to compact areas, and, with the use of high pressure, to scattered or isolated compact areas. The chief advantages of the direct-current system were the possibility of using storage-batteries, which could not be employed with the alternating-current systems, greater efficiency in distribution and greater adaptability to motive power. The undertakings using the system were the Chelsea Company (high pressure), Charing Cross and Strand Corporation (high pressure), the Westminster Corporation, the St. James's and Pall Mall Company, the Kensington and Knightsbridge Company, the Notting Hill Company, the St. Pancras Vestry and the Metropolitan Company (at one works).

The generating works of the several undertakings in London contained many interesting features. No

less than twenty different works had been erected. The boilers used comprised the water-tube, marine, Lancashire, and miscellaneous types; but the preference for the water-tube boiler was very marked. The works were liable to sudden demands through fogs, and the quick-steaming properties of this type of boiler were of great advantage. The boilers were fired chiefly by hand with Welsh coal, but in the works of the City of London Company and the County of London Company mechanical stokers and cheaper coal were used. The use of extensive systems of steam-pipes was now being dispensed with. The multiplicity of valves was unnecessary, and the number of valves was being reduced, and arrangements were made as simple and with as few joints as possible.

The present tendency was towards engines of the marine type for large outputs. The high-speed engine was not used for larger powers than 750 HP. Some engineers, however, found engines of 350 HP. sufficiently large and the most convenient unit to adopt. The dynamos were similar in most works, and were always connected direct to the engines. Storage by secondary batteries was not extensively employed in London, as their maintenance had hitherto proved expensive. But a few works used them entirely for maintaining the supply after midnight, and in the daytime in summer. The author gave the results of a test of a small marine engine and alternator, showing the combined efficiency to be 85.5 per cent. The question of vibration had been of great importance in many works; no cure had been found effective when once vibrations were set up. High-speed engines must have three cranks to be free from appreciable vibration.

The favorite methods of distributing electricity were to transmit current at a high pressure in heavily-insulated cables in iron pipes, and current at a low pressure in insulated cable in stoneware conduits or in cables heavily armored and laid direct in the ground. Rubber was now little used, paper and jute, impregnated with insulating compounds, having been extensively adopted.

The industry was growing so rapidly that most undertakings had to seek new sites for generating works, and the tendency was to erect large works on the outskirts of London, where coal could be conveniently brought to the site, and where water could be obtained for condensing. The powers granted under Provisional Orders were limited as regards the compulsory purchase of land, and further powers were being sought by some companies from Parliament, so that they might be placed on the same footing as railway companies. No less than 40,000 HP. is now being installed in London in order to meet the demand for electricity in the immediate future.

A 100-Mile Transmission Scheme.

According to the *Frankfurter Zeitung* a scheme has been worked out in Stockholm for the utilization of part of the 100,000 HP. running to waste in the waterfall of Elfkärlaby, 100 miles from that city. The idea of transmitting a part of this power to Stockholm has exercised the minds of the citizens for some time past, and has within the last few months assumed a more practical form, several engineers and electricians having been commissioned to work out a detailed scheme. This project is now ready. It is proposed to utilize in the first instance "only 20,000 HP." of that available, and the estimated cost of the installation works out as follows: Power station, including all the necessary works and machinery, £178,000; transmission line, £237,000; buildings and transformers in Stockholm, £29,000; making a total of £444,000. A loss of 5,000 HP. is estimated so that 15,000 HP. would be available in Stockholm. This is to be sold at 4½s. 5d. per horse-power per year, making an aggregate revenue of £33,300 per year. Without making any allowance for working expenses, our contemporary naively remarks that this yearly revenue capitalized at 4 per cent. is equivalent to £833,000 and that there is a consequent gain of nearly £400,000 to the State.—*Electrician, London.*

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XVIII.—Antimony, Chromium, Magnesium and Nickel.

In this chapter it is proposed to give some account of the processes that have been used, or are now being used, for the production upon an industrial scale of the four metals named above.

Only two of these metals—antimony and nickel—are of much commercial importance, and in the case of the other two, one manufactory could easily supply the present world's demand; but the electrolytic methods for the production of these metals are still of interest as exemplifying the point, often noticed in previous chapters, that it is the greater convenience, and purity of the products, of the electrolytic methods, rather than their greater economy, that has caused them in many cases to supersede the older methods.

Owing to the secrecy which is always observed when a process is worked in one or two places only, and to the absence of all inducements to publish details of the apparatus or procedure used, the facts given in this chapter will necessarily be less full and complete than has been the case in the preceding chapters of the series.

Antimony.—One of the earliest attempts to separate this metal from a solution of one of its salts by electrolysis was made by Gore in 1858. An aqueous solution of antimony trichloride containing excess of hydrochloric acid was used as the electrolyte, with a cathode of copper and an anode of antimony. In place of the metallic deposit which he expected, he obtained a compound of antimony and antimony trichloride, known as "explosive antimony" on account of its property of decomposing with explosive force when rubbed. The deposition of metallic antimony from its solutions upon a commercial scale remained in abeyance for many years after this date, and it is only recently that the appearance upon the market of thin plates of the metal of extreme density has proved that some of the difficulties in the production of metallic antimony by electrolytic methods have been overcome. These plates, according to Borchers, have been made by the Austrian branch of Siemens & Halske, but no details of the place of production, or the quantity produced, have yet been made public. The process patented* by Siemens & Halske for the electrolytic extraction of antimony from its ores has most probably been used for the production of these plates, and the following brief account of it may therefore be given.

The process depends upon the solubility of antimony sulphides in solutions of sodium or potassium hydrosulphide, and the use of the electric current to deposit the antimony as metal from such solutions.

The chemical and electrolytic reactions which occur are as follows:

1. $\text{Sb}_2\text{S}_3 + 6\text{NaHS} = 2\text{Na}_3\text{SbS}_3 + 3\text{H}_2\text{S}$
2. $\text{Na}_3\text{SbS}_3 = 3\text{Na} + \text{SbS}_3$
3. $6\text{Na} + 6\text{H}_2\text{O} = 6\text{NaOH} + 6\text{H}$
4. $\text{SbS}_3 + 6\text{H} = \text{Sb} + 3\text{SH}_2$
5. $3\text{NaOH} + 3\text{SH}_2 = 3\text{NaHS} + 3\text{H}_2\text{O}$

The solution of the antimony sulphide by the solvent, represented by equation (1) takes place in a leaching vat, in which the crushed ore is treated with the solution of sodium hydrosulphide.

The solution is then separated from the residuum in a filtering vat, and is run into the electrolyzing vat where it is subjected to electrolysis.

Equation (2) shows the direct products of the electrolysis, while equations (3), (4) and (5) show the secondary reactions which immediately follow, and produce as a final result—antimony at the cathode and sodium hydrosulphide at the anode. If desired, the electrolysis can be carried out with a

solution of sodium chloride in the anode chamber of the depositing cell. In this case, free chlorine will be obtained at the anode, and by suitable arrangements it can be collected and used for opening up refractory ores.

Borchers, who has designed an apparatus for depositing antimony from the same solution, states that an EMF. of between 2 and 2½ volts is sufficient to give a current density of from 4 to 5 amperes per square foot.

The greater number of antimony ores can be easily dealt with by the present furnace methods of reduction, and it is only in connection with refractory ores, or with furnace mattes, that the electrolytic method is likely to develop. At present it is hardly of any industrial importance; and it has only received mention because electrolytic antimony has been put upon the metal market in Europe.

Chromium.—This metal was first obtained by electrolytic methods by Bunsen in the year 1854. He used a solution containing both chromous and chromic chlorides, and he was surprised to find that by varying the current density employed he could obtain either hydrogen, chromium, sesquioxide, chromium trioxide, or metallic chromium at the cathode. This historic experiment showed the important part played by the current density in determining the final products of the electrolysis. More recently Moissan, the distinguished French chemist, has obtained chromium by a method that is purely chemical in character, though electricity has been used to produce the heat required. Moissan heated chromium sesquioxide with carbon, in his electric furnace, and in this way obtained reduction of the oxide by the carbon, and the production of metallic chromium.

The metal is now produced commercially by the "Elektro Chemische Werke," Bitterfeld, but no details of the process or apparatus used have been published. The writer believes, however, that it is produced by a method based upon that of Moissan, though doubtless the details of the process and of the furnace construction differ from those used by Moissan himself. It may be added that the honor of the discovery of the fact that all oxides could be reduced by carbon at the temperature of the electric furnace is shared with Moissan by Borchers, though it was Moissan alone who systematically investigated electric-furnace reactions.

Chromium is of importance, not only as the metal which possesses the highest melting point (it cannot be fused in the oxy-hydrogen flame) but also because it confers great hardness upon metals with which it is alloyed. Though an electrolytic method of depositing chromium from mixed solutions of its sulphate and potassium sulphate has been patented by MM. Placet & Bonet (U. S. A. patent No. 526,114) it is probable that the demand for metallic chromium in the arts will be wholly met by the electro-metallurgical method that has been described.

Magnesium.—In the year 1832 Becquerel, one of the early experimenters in electro-chemical science, is stated to have obtained metallic magnesium by electrolysis of a concentrated solution of magnesium chloride. Magnesium is one of the metals which cannot exist as such in the presence of water, but under certain conditions small quantities of the metal can be obtained at the cathode from aqueous solutions of the chloride.* There is no doubt however that in 1848 Wohler prepared large quantities of magnesium by electrolysis of the fused chloride, and Bunsen in 1854 repeated the experiment, substituting however a mixture of ammonium and magnesium chlorides for the latter salt, on account of the greater ease with which it could be prepared. Matthiessen later used a mixture of potassium and magnesium chlorides for the electrolysis; and this is the method now followed at the "Aluminium und Magnesium Werke" at Hemelingen in Germany,

carnallite, a natural product (of the composition $\text{MgCl}_2 \cdot \text{KCl} \cdot 6\text{H}_2\text{O}$), being substituted for the artificial mixture suggested by Matthiessen. The carnallite is fused in a metal or porcelain pot, by external heating, and the fused mass is electrolyzed with carbon anodes and metal cathodes. The magnesium as it separates at the cathode collects into globules, and falls to the bottom of the vessel in the molten state. Reducing gases are led into the pots during the electrolysis through openings in the covers, but according to Borchers this is an unnecessary precaution. An EMF. of 7 to 8 volts will suffice to produce a current of 90 amperes per square foot through the molten carnallite. In addition to the factory at Hemelingen, magnesium is produced at "Grabau's Aluminium Werke" at Trotha, near Halle, and at the "Elektro-Chemische Werke," Bitterfeld. Though no details of the process or apparatus used at these works have been published, there cannot be any doubt that in principle the process resembles that used at Hemelingen, though the apparatus in which it is carried out doubtless differs in each works. Oettel states that in consequence of the adoption of electrolytic methods the price of magnesium has dropped 70 per cent.; in this case, therefore, the gain has been not only in convenience and purity of the product, but also in economy.

Nickel.—This metal was first obtained as a deposit upon the cathode of an electrolytic cell by Gabn, in the earliest years of the century, before even Davy had discovered potassium and sodium by electrolysis of their fused hydrates. Nothing further was done in connection with the electrolytic deposition of nickel until 1862, when the two Becquerels published the account of their researches upon the best conditions for obtaining adherent and homogeneous deposits of many metals, nickel being one of the number. The solution which yielded the best result in their hands was a neutral nickel sulphate solution. The progress of electroplating, in which for nickel deposits solutions containing nickel and ammonium sulphates were employed, led to great improvements in the coatings of nickel obtained by electrolytic methods, but it was not until recent years that the production of nickel for commercial purposes was attempted by means of electrolysis. The delay in further development was caused by the inability to produce coatings of the metal of any considerable thickness; scaling and other evils always occurred when a certain point was exceeded. Foerster has recently shown that if the electrolyte be heated to between 60° and 90° C., tough deposits of nickel of any desired thickness can be obtained, without the exhibition of any tendency to scale.* In Europe, so far as the writer is aware, there is only one firm producing electrolytic nickel, namely "Gustav Menne u. Cie." of Siegen, Germany, but in America the "Orford Copper Company" and the "Canadian Copper Company" are both producing nickel by electrolytic methods. In all these cases the principle of the process used is the same. A matte or regulus containing copper and nickel produced by ordinary metallurgical methods is used as anode; and a deposition of the one metal is effected while the other remains in solution. At Siegen, the writer understands that they are using a regulus containing 40 per cent. copper and 30 per cent. nickel, and the electrolyte is believed to be a solution of copper or nickel sulphate. If acid, copper alone is deposited, while if the solution be neutral, the nickel will be deposited also. This difference has been made the basis of an analytic method for the separation of copper and nickel, so its effectiveness for obtaining a separation of the two metals upon an industrial scale is assured. Nickel is one of those metals for which there is a steady and growing demand in the arts, and since the separation of copper and nickel is not easily effected by furnace methods of procedure, there would appear to be a highly successful future before the electrolytic nickel industry.†

* Zeits. f. Elektrochemie, Vol. IV, p. 160.

† The historical notes in this article have been taken from Ahrens' "Handbuch der Elektrochemie," Stuttgart 1896.

* German patent, No. 67,973.

* Lupke. "Grundzüge der Elektrochemie," 1896, p. 150.

APRIL 27, 1898.]

SOME RECENT IMPROVEMENTS IN ACCUMULATORS AND THEIR APPLICATION TO TRACTION ON COMMON ROADS.*

BY J. T. NIBLETT.

(Continued from page 231.)

FAURE, OR PASTED CELLS.

Camille Faure, appreciating the inconvenience incidental to Planté's electrolytic method of producing battery plates, conceived the idea of accelerating the operation by applying a layer of chemically-prepared oxide of lead to their surfaces, and then converting it into active material by the action of an electric current. With this end in view he thinly coated lead plates with red lead made into a thick paste by the addition of acidulated water. After being thoroughly dried these prepared plates were placed in a bath of dilute sulphuric acid, and were then subjected to the action of an electric current. To prevent the disintegration of the lead salts he interposed between each of the plates a layer of porous felt or cloth. After passing the electric current through such a combination for some time, Faure found that the oxide of lead on the positive plate was converted into peroxide of lead, while the salt on the negative had been reduced to finely divided or porous lead. Owing to the defects which speedily developed in Faure's original plates, they never came into commercial use. It was found by repeated charging and discharging the loose lead salts permeated through the pores of the porous separating medium and thereby induced the formation of what is known as "lead trees," which short circuited and ultimately destroyed the elements. The inert porous separating medium therefore had to be abandoned, and the difficulty was overcome by leaving a clear liquid space between each plate. Much ingenuity has been exercised by various workers in devising methods of holding active material, and many of these devices have been made the subject of patents.

Messrs. Sellon, King, Volkmar, Philippart, Parker, Swan and others have each devised methods of holding active material on grids, frames or plates. These methods, combined with Faure's original discovery, constitute that group of inventions owned by the Electrical Power & Storage Company, and are well known shortly as the E. P. S. patents. The elements as originally made and largely used by the above company were perforated with a large number of square apertures, tapered inwards from both surfaces, thus forming a double dovetail. Owing to their peculiar shape, the pellets of active material tend to key themselves firmly into the countersunk holes. The metal frames are cast in a metal chill or mould, and when cleaned up the frames are filled in with the material to be rendered active. The positive frames are filled or "pasted" in with red lead made into a paste by the addition of a solution of 1 part sulphuric acid to 8 parts of water. The material used for the negative element is litharge mixed with sulphuric acid, 1 part added to 20 parts water. When dry, the plates are placed in a bath containing dilute sulphuric acid, where they are partly formed, or what is known as "hardened," by means of an electric current. After being hardened, the plates are removed from the bath and placed in a suitable frame, and their connecting lugs are lead-burned together. When treated as above, the elements are fit for sale purposes. In all cases the actual forming is done by the purchasers.

Of late years improvements have been made in the original E. P. S. plates. The King-Faure plate, now much used, has a series of ledges cast upon it on both sides, and these ledges are filled in with the active material. Plates made on this principle are much

thicker than those originally made, and are said to give a greater capacity per pound of plate. The accumulators made by the E. P. S. Company, and so extensively used for electric light purposes, are so well known that they scarcely need further description here. We shall, however, have occasion to again refer to this company's traction cells later on.

Since the year 18-0 considerably over a thousand applications for British letters patent have been made for improvements in secondary batteries, chiefly of the Faure pattern, and of these some hundreds have developed into fully published patents. The great majority of the suggested improvements are of a mechanical nature and refer more especially to: (1) Methods of accelerating formation; (2) devices for preventing disintegration of the active material; (3) attempts to construct a mechanically solid cell; and (4) means to prevent that great bugbear of all lead accumulators—the warping and buckling of the plates or grids.

It is not within the scope of this communication to investigate all the attempts made to overcome the above-mentioned difficulties, and only a few of those batteries now on the market will be considered. In addition to the improvements noticed here much has been done in this country by Sir Edward Frankland, Messrs. Reekenzann, Drake, Gorham, Barber-Starkey, Pitkin, Bristol and others. On the Continent, Messrs. Reynier, Tommasi, Gadot, Hagen, Jacquet, Payen, Laurent-Cely, Pollak and Blot are each credited with improvements; while Messrs. Brush, Eickemeyer, Ernst, Carpenter, Knowles, Hering, Gibson, Currie, and Winkler, in America, have modified with some amount of success either Planté's or Faure's original inventions.

A form of accumulator which has been received with much favor on the Continent is known as the "Tudor." Of late years this form of cell has been introduced into this country, and is now manufactured by the Tudor Accumulator Company. The elements are not of the grid form, but consist of lead plates deeply grooved, made by being passed between a pair of suitably-made rollers. The grooves in the negative plate are narrower than those on the positive. When prepared in this way the plates are coated by electrolysis with a thin layer of peroxide, and the interstices are then filled in with the usual paste of lead oxide. The reason for treating the plates in this way is to prevent the formation of sulphate of lead at the junction of the metal holder and the active material. After the above treatment the plates are allowed to dry and are passed through smooth rollers. This last process closes up the grooves and tends to key the active material in.

According to Prof. Kohlrausch, who made some tests of the original Tudor cell, he found that a capacity of 1.6 ampere hours per pound of plate was obtained by a cell of the following dimensions: The weight of the elements was 29.3 lbs., the total active surface of the positive plate was 1.29 square feet, the amount of electrolyte was 6 pints. Such a cell was stated to have an internal resistance of 0.015 ohm when charged, and 0.02 ohm when discharged. The best charging rate was found to be 5 amperes, and the discharging rate 6.5 amperes. As a mean of six ordinary charges and discharges a current efficiency of over 90 per cent. was said to be obtained. We believe that since the above test, and owing to improvements made, far better results have recently been obtained.

A material for making the elements of secondary batteries quite distinct from any of those already considered is known as lithanode. The credit of devising lithanode is doubtless due to Mr. Desmond FitzGerald, whose labor in the field of electro-chemistry is well known. Batteries, with improvements made on Mr. FitzGerald's original invention, are now made by the Lithanode Electric Storage Company.

Lithanode is not compressed peroxide of lead, as is sometimes supposed; for, however strongly this lead

peroxide may be compressed, the resulting mass will disintegrate when immersed in a liquid electrolyte. It is produced from litharge made into a pasty mass with a solution of sulphate of ammonia, which causes the material to "set," so that it will no longer disintegrate when placed in a fluid. The "forming," according to the original idea, was performed in a bath of sulphate of magnesia. In ordinary practice the elements are made up of a number of small slabs of lithanode, whose outer edges are V-shaped. These slabs or pellets are arranged in a casting mould of any suitable dimensions, and are placed at such a distance apart and from the edges of the casting frame as to allow of sufficient space for the requisite quantity of metal to run in and impart adequate mechanical strength to the completed element. After the pellets have been arranged in this manner, an alloy of lead and antimony is run into the interstices, and thus a complete plate is formed.

Before being cast up the positive pellets are converted into peroxide of lead in a forming bath; those for the negative plate are simply dried and cast up direct, the lithanode in the latter case being reduced to a condition of spongy lead by the ordinary electrolytic method.

Where lightness is a desideratum, as in the case of a traction cell, the pellets in the positive plates are made larger, while the negative plate is constructed of lead gauze, having its outer edge strengthened by a rim of lead. The gauze is filled in with the prepared litharge, which entangles itself in the thin lead wire, and thus produces a plate of great lightness and one little liable to fall to pieces.

Lithanode may be obtained in varying degrees of porosity. For high discharges it is made of a highly porous nature, the porosity being produced by incorporating in the material crystals of some salt which is practically inert and which is dissolved out during the forming operation.

The rate of discharge obtainable from lithanode batteries varies between very wide limits, and is regulated by the character of the lithanode, whether made hard, medium or soft. The ordinary working rate of discharge is one-fourteenth of an ampere per square inch of lithanode plate, but owing to recent improvements very much higher rates of discharge can be obtained.

The electrical capacity of lithanode, when discharged at the above rate, is almost exactly one ampere hour per ounce, so that in a lithanode element weighing 1 lb. a current capacity of 16 ampere hours is obtained. In practice, however, this high capacity is never reached.

Thinking it may be of interest I have prepared the following particulars taken from one of the company's most popular types of portable battery:

Data of Complete 30 Ampere hour Lithanode Batteries, including Wood Cases.

No. of cells.	Outside dimensions of battery.			Open EMF. of battery.	Approximate gross weight of battery.
	Length.	Width.	Height.		
	Inches.	Inches.	Inches.	Volts.	Lbs.
1	3.75	7.00	6.37	2	8½
2	5.12	7.00	6.37	4	16
3	7.27	7.37	7.00	6	22½
4	9.50	7.37	7.00	8	29
5	11.60	7.37	7.00	10	36
6	13.75	7.37	7.00	12	43
7	15.78	7.37	7.00	14	50
8	18.00	7.37	7.00	16	58½
9	20.12	7.37	7.00	18	66½
10	22.24	7.37	7.00	20	74½
11	24.36	7.37	7.00	22	82½
12	26.50	7.37	7.00	24	90½

Detailed Particulars of Cell.

Vulcanite containing cell, 6.25 inches long, 2.12 inches wide, 5.2 inches high, 10 ounces weight; positive element (two plates in each cell), 5.9 inches long, 3.9 inches wide, 0.5 inch thick, 1 pound 1½ ounces weight; negative elements (three plates in each cell), 5.9 inches long, 3.9 inches wide, 0.13 inch thick, 11½ ounces weight. Weight of connectors, 3 ounces. Weight of cover, vent plug, sealing and separators, 2 ozs. Quantity of electrolyte, 15.5 fluid ounces.

* Paper read before the Self-Propelled Traffic Association, Liverpool Center, Eng., March 29, 1898.

Gross weight of complete cell, 6 pounds 7 ounces.
 Normal charging rate, 3 amperes.
 Normal discharging rate, 3 to 4 amperes.
 Maximum safe discharging rate, 9 to 12 amperes.
 Approximate internal resistance, 0.015 ohm.

The data given will give a fair idea of what is obtained in actual working with this form of cell. Other batteries of larger capacity are, of course, made, and as the capacity increases, the proportional weight and bulk slightly decreases. These batteries have been used extensively for lighting vehicles, actuating coils for X-ray photography, and for propelling electric launches and light forms of motor cars.

The Chloride Electrical Storage Syndicate make their accumulator plates on a somewhat similar plan to that adopted by the Lithanode Company. In this case, however, instead of using litharge, chloride of lead is employed to make the pellets. The method of making chloride plates is somewhat as follows: Litharge is dissolved in acetic acid, which gives the resultant compound of acetate of lead. By adding hydrochloric acid to this solution, chloride of lead is precipitated. The precipitate is next passed through a filtering press, which squeezes out the acetic acid and leaves the chloride of lead in the shape of cakes. The cakes of chloride of lead so prepared are dried and put into melting pans with a small percentage of zinc. When melted the salt is run into a suitable mould, the result being the production of small hexagonal pellets. The pellets are next arranged in a metal chill, and an alloy of lead and antimony in a molten state and under pressure is forced into the interstices. The next process is to reduce the chloride. This is done by placing the plates in a reducing tank, alternately a cast plate and then a plate of zinc. The zinc combines with the chlorine, forming chloride of zinc and reducing the lead salt into pure spongy lead. Originally both the positive and negative elements were made in this way, the spongy lead in the positive plate being converted into peroxide by the usual electrolytic method. Now, however, following out the prevailing fashion, the chloride plate is only used as the negative element, the positive is of different construction and is of the Planté type. The positive plate, which is cast in a mould, has a large number of holes in it. These are about three-quarters of an inch in diameter, and slightly tapered outwards on both sides of the plate. Into the cast holes are pressed small rosettes of lead. These, which exactly fit the holes, consist of lengths of pure lead strip gimped and rolled up in the form of small coils. When all the apertures are filled in the plates are submitted to pressure in a hydraulic press, which operation keys in the rosettes. The formation is effected by joining up the plates to dummy negatives and peroxidizing in an electrolytic bath in the usual manner.

Chloride cells are well known and largely used for traction purposes in America, and they are very well received in this country also.

A form of cell which is just now exciting much attention on the Continent is known as the "Marschner" cell. The Marschner battery is at present being used on the Dresden tramways, and it is said to be behaving in a very satisfactory manner. The plates are stated to consist of the ordinary oxides of lead, incorporated with powdered amber and an essential oil. This mixture is said to "set" very hard, the resultant plate being of a tough metal-like nature. On the Dresden car 144 cells of this type are being used. Each cell contains 13 plates, and is said to weigh only about 28 lbs. The weight of the complete battery is given as 5,290 lbs. Its efficiency is stated to be over 90 per cent., and if discharged at its normal rate—that is, 65 amperes—an energy capacity of 13 watt hours per pound of cell is obtained.

When devising cells for traction purposes many difficulties have to be overcome. Owing to their high initial cost, a small number of cells should be made to suffice, and these should be so con-

structed that they will run a vehicle for a reasonable number of hours with one charge. They should be capable of being charged and discharged at rapid rates. Above all, they should be able to withstand the jolting and jarring incidental to their being run over rough and uneven roads. The cell should be so constructed that the wash of the electrolyte does not remove the active material.

There is at the present moment an enormous field for an inexpensive cell which will combine large capacity with small weight and great solidity. Some form of mechanically solid cell seems to offer the best solution for this problem. Some little time ago great hopes were entertained that the solidity problem had been solved by the introduction of Dr. Schoop's solid electrolyte. This so-called solid electrolyte was made by adding silicate of soda to the ordinary solution, which caused it to set and become of a gelatinous nature. In this country some practical tests have been made with Mr. Barber-Starkey's method of making solid cells by substituting for the electrolyte a mixture of wood sawdust and plaster-of-paris, which when set was moistened with dilute sulphuric acid.

The accumulator known in America as the "Hatch" is of a mechanically solid nature. In this case metallic frames are not employed for supporting the lead salts, as they are held within a porous earthenware grid serrated on one side and having small square recesses on the other. Plain lead plates are used as conductors, and these are bedded on the moist lead salts. According to this arrangement there is no clear liquid space between the elements, as the serrated earthenware plates touch one another and are so placed that the ridges on one plate are placed at right angles to those on the other. Wooden clamping plates with india-rubber bands placed around them are fixed on the outside of each end element, and these serve to give the requisite elasticity. The "Pumpelly" cell is another American production, and in this case the mechanical solidity of the cell is arrived at by inserting plain, thick, porous earthenware plates between the elements. In this case, however, the plates are placed horizontally instead of vertically as in the "Hatch."

One great drawback to the employment of a viscous, gelatinous, or semi-solid electrolyte arises from the fact that when such substances are interposed between the plates no free circulation of the liquid is possible. In all secondary batteries, as already shown, the activity of the elements depends entirely upon chemical action, and as the electrolyte is a medium through which all these reactions occur, it seems highly probable that anything which prevents its free access to the active material, or in any way impedes its circulation, must be detrimental, and consequently lead to loss of efficiency and capacity.

Some few years ago, having in view the advantages likely to be derived from the employment of a mechanically solid cell, for traction purposes, the author gave some attention to this particular form of battery, and a number of cells were constructed having this object in view. In most cases the elements consisted of a highly cellular mass of active material, which was capable of absorbing a sufficient quantity of electrolyte for the due performance of all the necessary chemical actions. Between each mass of active material was inserted a thin, highly porous, inert diaphragm, which was not found to materially increase the internal resistance, and served to complete the solid character of the cell. A large number of different combinations with various kinds of active material were tried. Owing to the cellular nature of these elements the liquid contained in the mass continually circulated, the slight evolution of gas which occurred during both the charging and discharging operations being quite sufficient to effect this. The active material was in all cases so placed that it could not be dislodged. It was found that the cellular character of the electrodes gave them a

peculiar power of regulating their own internal resistance, for if the cell was being charged at too high a rate, or when it was on the point of being fully charged, the gas generated tended to drive the liquid out of the pores of the electrodes and remained imprisoned therein, thereby greatly increasing the resistance and stopping the flow of current. On the discharge, the occluded gas appeared to re-enter into the chemical combination and allow the liquid to refill the pores, thereby exposing more active surface. Little or no commercial use was made of this plan of construction, as at the time the author's attention was diverted into other channels, and the matter was dropped.

Probably no individual type of secondary cell will be found to answer for the very varied and ever-increasing purposes to which this class of apparatus is now being applied, and it follows that some form of specialization must occur.

For central electric light stations, or for such work as leveling up the loads on electric tramways, where moderately constant work is required, a battery whose weight is large, or whose bulk is great, may be safely used. For self-contained electric light installations, weight and space occupied by the battery is of some moment; and where intermittent charging only is resorted to, absence of local action is desirable. The battery, under these circumstances may have to stand idle for considerable periods, and it would not do for it to lose its charge while thus waiting. For traction purposes, where charging each day, or even several times per day, may be practised, local action is not such an objection, and the loss sustained thereby may be neglected. For some forms of vehicles, such as broughams, dog-carts, tricycles and the like, which may be only occasionally required, and may have considerable waits between the periods of use—waits which may extend over days and even weeks—the absence of local action is essential. A fifth class of apparatus in which storage batteries are now playing a most important part is that of self-contained portable electric lamps, so largely used for medical and other purposes. In this case absence of local action, lightness and compactness, together with great mechanical strength, is absolutely essential. In many cases such lamps are required to hold their current for many months, and this can only be obtained where there is little or no local action. Again, as the plates used in these small batteries are of small dimensions the form of construction may be such as is not permissible in any other class of apparatus.

"Local action," it may be explained, is the term given by electricians to that frittering away of energy which frequently occurs while a cell is at rest. This wasting is experienced in nearly all forms of primary cells and in many types of secondary cells. In the case of secondary cells it is due to the establishment of voltaic couples between the metal support and molecules of lead salt when in the presence of sulphuric acid and water. This troublesome complaint leads to the destruction of the peroxide and the formation of sulphate of lead, and it not only reduces the capacity of the cell, but it frequently leads to its ruin. In the Planté cell, with its large metal surface and thin layer of active material, local action is far more prevalent than in the Faure, with its comparatively smooth and small metal surface and thick masses of lead oxide.

(To be continued.)

Electric Lighting of Trains in India.

The Jodhpore-Bikanir Railway is setting an example in this matter. The manager's reserved carriage was fitted up some time ago with Stone's system of electric lighting, which has worked satisfactorily. Urged by this success the railway is going to use the above system on a whole train, the dynamo and accumulators being placed in the brake van.

WIRELESS TELEGRAPHY.*

BY W. J. CLARKE.

DISCUSSION.

(Concluded from page 229.)

Mr. Knight—What would be the practical outcome of the application of this invention?

Mr. Clarke—My idea is that it would be used largely for transmission between ships and the shore, and I think in the near future we will have a system of telephoning without wires for private use. In fact that is almost a certainty at the present time.

Mr. Hamblett—In the case of communicating from ships to the shore, suppose two steamers were fitted with the apparatus and undertook to operate together, how would you distinguish between one message and the other? Would there not be an interference in that case?

Mr. Clarke—That is something we will have to overcome. It may be that by tuning our apparatus properly there will not be any interference to any great extent; and if there is, I think that American ingenuity will overcome it.

Dr. Pupin—You cannot tune it effectively. I think you said this before the American Institute, that it works as well whether you tune it or do not tune it. It is as effective in one case as in the other. Is there any proposition made as to the method of tuning?

Mr. Clarke—I have read of a great many experiments that have been made in that line, but I agree with you in the fact that none of them have produced very good results.

Dr. Pupin—Have they proposed any method of bringing that result about, or are they groping in the dark?

Mr. Clarke—They are groping in the dark, so far as I can see.

Mr. Knight—In what way would this system be introduced in telephoning without wires?

Mr. Clarke—That at present cannot be divulged, but I might say in regard to transmitting signals, when there is much outside noise the telephone receiver is much to be preferred to the ordinary sounder.

Mr. Dunn—I believe Mr. Preece made some experiments some years ago, and found that telegraph circuits could be read by telephone when the circuits carrying them were forty miles apart. Such a system of telephoning would be useless unless the tuning is successful.

Mr. Clarke—There are two ways of looking at that. If a system of telephoning of that kind is devised, it will be used probably between a place of business and a residence. We will say that Mr. A. has a telephone in his residence and one in his place of business, and Mr. B. another; but they will be so far separated that they will not affect one another.

Dr. Pupin—You have six balls in the small arrangement and only two in the other?

Mr. Clarke—This transmitter was constructed when the announcement was made that Marconi used balls four inches in diameter. I had an idea that the small balls would be sufficient if there were enough of them. We find that we get fully as good results by using three instead of six, or two large ones.

Mr. Mailloux—In winding these relays with two or more windings in multiple, has the experiment been tried of using windings of unequal resistances or numbers of turns? The expediency of using multiple windings for the purpose of reducing the sparking is old, and is found quite successful. It is due to the fact that the two coils have different time-constants; that is to say, the ratio between the number of turns and the resistance is different for the two coils. At the time the current dies out it dies out in one coil before the other, and that coil be-

comes a short-circuit path for the other to some extent. Some years ago a telephone system was devised (known as the Gillette system) which depended upon having induction coils with several windings connected in multiple in the same way. I was interested in knowing, in this case, if the effect of a definite difference in the ratio of the inductance (that is to say, the number of turns,) to the resistance in these coils has been tried to accentuate that difference in the time-constants as much as possible.

Mr. Clarke—We have not tried it that way. All our windings have been of the same resistance.

Mr. Mailloux—They are probably not equal in the number of turns. There would inevitably be a difference in winding, it being almost impossible to wind two coils alike with fine wires. This would make a difference which I think is the reason to which the spark-killing effects noted must be ascribed. If you were to accentuate that difference by increasing the resistance of one coil, or increasing its number of turns, I think you would find you will get a still better result. When the coils are being magnetized or energized it will make very little difference, because the one having the greater time-constant will simply force more current through the other at first. When the exciting current is out off, the coil having the smallest time-constant is discharged first, and it then serves as a shunt for the other coil or coils. The greater the difference between the time-constants, the greater must be the spark-killing effect.

Dr. Pupin—Does Mr. Marconi always connect one terminal of the induction coil and one terminal of the coherer to the ground?

Mr. Clarke—No, not always. He frequently places the transmitter high in the air, and also the receiver, and uses wings on the coherer out to a proper length, to be in what we might call "tune" with the transmitter.

Dr. Pupin—Then I should say that there is a radical difference between the two methods by which he transmits signals between two stations. In the case of grounded circuits, it is not so much the action of the waves transmitted through the air that affects the coherer as it is the ground currents running between the two plates indicated in your diagram by C, because these two plates are actually the plates of a condenser which is being charged by the induction coil, and the charging current causes the resistance of the coherer to diminish. It is in fact the same thing as wabbling the charge of the earth, which Mr. Tesla proposed some time ago. In this case it would be more or less of secondary importance whether we employed excessively rapid or, comparatively speaking, slow vibration, and in fact I should think that the coherer would operate even if a spark between the terminals of the secondary of the induction coil did not take place.

Mr. Clarke—We find that for very short distances the coherer will operate even when a spark is not passing across the terminals of the induction coil, but when operating for a considerable distance we find it is absolutely essential to use the plates in the air, and Mr. Marconi claims to find that the greater the heights of the plates in the air, the greater the distance to which he can transmit his signals.

Dr. Pupin—As far as I can see, Mr. Marconi's apparatus does not represent the solution of the most important problem in connection with long-distance signaling without wires, or rather long-distance signaling by means of electrical waves. This problem can be stated as follows: To construct an electrical oscillator of very short period, say one hundred thousand million vibrations per second, the vibrations having a small decrement, that is to say, the vibrations having once started should continue for a considerable number of periods, say five or six hundred periods. Vibrations of this kind are necessary it seems to me. They should have very short wave lengths, so as to enable us to construct reflectors of reasonable size which could focus them, and

they should have a small decrement, so as to be capable of producing powerful resonating effects, for without that selective signaling becomes impossible. So far as I know, nobody has been able yet to produce electrical waves of excessively short period and at the same time possessing small decrement, because to produce these rapid oscillations it is necessary to connect small conductors to the terminals of the induction coil, and in such cases the radiation of the electric waves is so enormous that the waves die out very rapidly so that after the first half wave there is hardly anything left. This was the trouble, for instance, with the waves produced by Prof. Lodge and others. It was on that account that successful experiments on the reflection and the interference of electrical waves became almost an impossibility. In a recent discussion given by Prof. Lodge, and published in the *London Electrician* I think, this difficulty has been emphasized more or less forcibly. Now as Mr. Marconi offers no suggestion in the line of solving this problem, and without the solution of this problem selective signaling by means of electrical waves will be made an impossibility, I think the commercial utility of the system will remain more or less small. Mr. Marconi does mention, to be sure, that he has been successful in tuning the receiver to the transmitter, but he does not state whether in this case he employed excessively short electrical waves or waves of considerable length. In fact the electrical reflectors play a rather unimportant part in his operations, and I should very much like to know whether he ever succeeded in tuning the receiving to the transmitting apparatus when he employed excessively short wave lengths, so short as to enable him to use reflecting mirrors of reasonable dimensions.

Mr. Clarke—I have not as yet tried selective signaling in any way. Lieut. Squires, of Fortress Monroe, tells me that he has produced some very successful results by the use of a Tesla coil, which is, of course, of much higher frequency than the one we have been using. My experience however has been, that up to a distance of half a mile, when the apparatus is in perfect adjustment, it is only necessary to simply open and close the primary circuit of the induction coil once in order that the receiver will respond. Now in regard to reflectors, we have been informed by those who have visited Mr. Marconi that he does not use a high-frequency apparatus, his best transmitter being equipped with an ordinary induction coil fitted with a comparatively slowly working make-and-break arrangement. He however claims to have used reflectors with excellent results. For my own part I have tried reflectors in every conceivable way, and found that they were no benefit whatever. I have taken the transmitter and receiver without being grounded in any way, and separated them just a sufficient distance to prevent the receiver from responding to the transmitter. I have then tried various sizes and shapes of reflectors, in order to ascertain if they would again bring the apparatus into operation, but to no purpose. I have also endeavored to follow up Mr. Marconi's idea of getting the transmitter and receiver in tune, and I have also signally failed in this direction. I presume, however, that this was due to the fact that the transmitter which I have used is not at all of high frequency.

Dr. Pupin—I am afraid that you did not exactly catch my meaning of the expression frequency. I refer not to the number of makes and breaks of the induction coil, for that really is immaterial, but to the electrical oscillations which are set up between the principal spheres after each passage of the electrical spark between them, and that frequency does not depend upon the size of the induction coil, nor on the potential with which it operates, but simply on the size and number of spheres and the distance between them, and also on the dielectrics separating them. Say, for instance, if we use spheres 30 centimeters in diameter, and separated from each

*Paper read before the New York Electrical Society.

other one meter, also having a rod running from one sphere to the other, with an air gap in the middle of it, the number of oscillations per second would be about one hundred millions. Now by diminishing these spheres continuously, and decreasing the distance between them gradually, we would increase the number of vibrations to anything we pleased. Say, for instance, the number of vibrations between two pin-heads, at a distance of say one hundred millimeters between them, would run into hundreds of thousands of millions per second, and the wave length would diminish from one meter down to the fraction of a millimeter, it is evident that with these shorter wave lengths we could employ small mirrors, for a reflecting mirror to act satisfactorily must have its dimensions large in comparison to the wave lengths of the waves which it is to reflect. As far as I know, neither Mr. Marconi, nor anybody else for that matter, has tried to adjust the dimensions of his reflecting mirrors to the dimensions of the wave lengths, and I venture to suggest that in this respect Mr. Marconi has been more or less negligent.

Mr. Clarke—We find that many of our experiments tend to confirm the correctness of your arguments. We began our experiments some months ago by using the same form of transmitter that Mr. Marconi used, consisting of two 4-inch solid brass balls, separated by about $\frac{1}{10}$ of an inch, and two small balls on the outside of the larger ones and separated from them by about an inch and a half, the inner hemispheres of the larger balls being immersed in a bath of oil. We certainly found excellent results from this arrangement, and we began gradually to decrease the size of the balls until finally we found that balls of only one-eighth of an inch in diameter were sufficient to operate the receiver at a considerable distance, but we found that when we substituted points for the balls we got no results whatever, and as we increased the distance between the transmitter and receiver we found it absolutely necessary, in order to make the receiver respond, to increase the size of the balls. In fact we have found, as far as we have gone, that the greater the distance, the greater must be the size of the balls upon the oscillator.

THE KINGSLAND SYSTEM OF ELECTRIC TRACTION.*

The designers of contact systems of electric traction using projecting contacts in the surface of the roadway are many, and as yet have not achieved much commercial success. This is largely due to the cost of their systems, and also to the number of the contact points required. In fact, the projecting contact and long collector, which has to make connection at all points of its length, is, in our opinion, the chief objection to the system from the local authorities' point of view. In Mr. W. Kingsland's system the number of contact points is less than in either of the two systems advocated by the leading American engineers. This is due to the fact that he uses the current from the power circuit to operate the automatic switches and that a subsidiary accumulator circuit is not used. Mr. Kingsland has a model of his line at work at the Faraday House, where we were able to inspect it and to glean the following details: The main feature of the electrical connections appears to be the fact that the current to every stud is controlled by two switches, of which one is operated by the car moving in one direction, and the other if the car moves in the opposite direction. Thus the switch-gear under one contact controls the supply of current to contacts on either side of it. The connections possible are many, and in his patent specification Mr. Kingsland describes these at length.

The arrangement preferred by the inventor con-

sists essentially of an electromagnet with two pole-pieces between which is a soft-iron armature rigidly attached to a spindle which is free to turn. At one end of the spindle is the main commutator switch, which is also free to turn independently on the spindle and is controlled by a quadrant-shaped boss. Fixed to the spindle is also a counterweight which normally keeps the spindle and armature in one particular position. The main commutator switch consists of a cylinder of insulating material on which are fixed two metal plates which cover approximately one-half of the cylinder, with a small space between the two, so that they are insulated from each other. The main commutator switch is in contact with four contact brushes or springs, connected respectively with the main conductor. At the opposite end of the spindle, and free to turn on it, is a small commutator switch operated in the same manner and at the same time as the main commutator switch. The metal plates on this smaller commutator, however, differ from those on the main commutator in that the insulating cylinder is entirely covered with metal with the exception of the upper half of, say, the end portion. There are three springs or brushes making contact with this smaller commutator, one being in contact with that part of the commutator which is covered with metal all round, and this will always be in electrical connection with it, while the other two brushes are arranged so as to make contact alternately as the switch is turned to the right or to the left, and the contact is broken with one just before it is made with the other. The small commutator serves to control the action of the electromagnet in the following manner: One end of the circuit on the field magnet is permanently connected to one contact brush and the other end to earth or to the return conductor. The other contact brushes are connected to the sectional rails on either side of the apparatus, consequently a current applied to either of the sectional rails will find its way to earth through the electromagnet, provided the small commutator is in the right position.

Supposing that a vehicle is passing over one sectional rail and is about to enter another. As the vehicle is traveling over the first this sectional rail will be in connection with the main conductor through the main commutator and two contacts. When the collector on the vehicle makes contact with the second sectional rail, which it does before leaving the first, the current will flow from the first section to the second through the collector, and from the second it will pass to the contact brush of the small commutator and thence through the field magnets to earth. The effect of this will be to act upon the armature of the electromagnet and turn the spindle, which latter by its attached sector-shaped parts will operate the large and the small commutators simultaneously, so that the contacts will be changed. If two branches of the switch are already connected, then the vehicle can collect the current from the second sectional rail, but if the switch should have been turned in the opposite direction, by reason of the previous passage of a vehicle in the same direction, then at the moment that the collector makes contact from the first to the second sectional rail a current will flow through the contact of the small commutator, and operating the electromagnet will alter the connection of the commutator from one pair of brushes to the other, and so in conjunction with the former two contacts of the switch will permit the vehicle to collect the current from the second sectional rail.

From the above description it will be seen that as soon as the contact bar touches two contacts in the roadway the rear one is disconnected from the main and put to earth through the shunt coil of the regulating switch-gear under it. This switch-gear work on the model was full size, and from what we could see would not be expensive to make. In it no springs whatever are used, and gravity is relied on for the return of the various counter-weights. The use of

an unwound Siemens armature as the moving part of the electromagnet is good, and the design arranged for placing the armature a little out of the central position, first in one direction and then in the other, is exceedingly ingenious. Certain details of this switch-gear and its case are yet to be devised, but we have no doubt but that Mr. Kingsland will be able to complete these satisfactorily. The use of the full 500 volts on the shunt winding of the electromagnets and the breaking the circuit repeatedly is perhaps the part of the system most likely to give trouble. Otherwise it is a well-thought-out system, and we trust it will obtain a practical trial.

NEW METHOD OF MEASURING THE INTENSITY OF MAGNETIC FIELDS.*

BY E. BOUTY.

I have recourse to the induction, reciprocal of that employed by M. Lippmann in his mercurial galvanometer. A liquid conductor, which may be simply river water, flows at right angles to the field to be measured. The constant electromotive force induced between two opposite faces of the stream is determined by means of a capillary electrometer; whence, knowing the flow, we can deduce the intensity of the field. To take a simple case, suppose the velocity of the flow, v , to be uniform over the whole section of a rectangular stream of depth, e , measured in the direction of the lines of force, and of width, l , measured in a direction perpendicular both to the lines of force and to the stream. The induced electromotive force is constant, and has a value E , where

$$E = H v l. \quad (1)$$

The flow is

$$D = v e l. \quad (2)$$

Whence

$$H = \frac{E e}{D}. \quad (3)$$

We have to apply this very simple formula.

Equation (1) shows that the induced electromotive force is independent of the nature of the liquid conductor. I employed at first solutions of sulphate of copper, both saturated and very dilute, flowing through a rectangular conduit or tube of ebonite. Two electrodes of copper .01 meter long and of a width, e , exactly occupy the side surfaces of the tube between the back and front faces of the stream. Having ascertained that the electromotive force measured is perfectly independent of the concentration of the solution, I was able, without making any other change, to substitute water from a tap for the sulphate of copper, the facility of making measurements remaining the same. Polarization of the electrodes introduces no disturbance.

Using water as the liquid conductor, high velocities of flow can be employed, and the sensitiveness of the method indefinitely increased.† With velocities varying from .5 meter to 17 meters per second, I have proved that the electromotive force is exactly proportional to the speed, and have detected fields of the order .5 C.G.S. unit. I see no reason to think that I have reached the limit of possible sensitiveness.

For comparative measurements neither the depth, e , of the tube nor the rate of flow, if it be kept constant, need be measured, and the tube may have any convenient form; but perfect insulation of the electrodes is absolutely necessary. For absolute measurements, a standard tube must be procured in which e is of such a size that the value of v may be treated as sensibly uniform over its sectional area, as we have supposed to be the case in the equations.

The copper electrodes of width, e , the depth of the tube, must be inserted into the walls so far from the inflow‡ that the velocity of the stream may be uni-

* Translation of a note presented to the French Academy of Sciences, January 17, 1898.—From *Electrical Review*, London.

† It is only limited practically by the maximum stream at one's disposal.

‡ Five cm. at least for tube of 5 mm. in depth.

* From the *Electrical Engineer*, London.

form over the area between them. Moreover, a correcting coefficient is required, differing however but little from unity, for the reduction of speed near the walls of the tube. For tubes from 1 to 6 millimeters deep, I find an expression $e + .13 \text{ mm.}$, representing the effective depth, may be substituted for e in equation (3).

Since the electromotive forces measured with different conduits are rigorously proportional to the field and to the stream velocity, one may determine by comparison with a standard tube the effective depth of any other tube, which may be extremely shallow, and afterwards use the latter as a secondary standard.

In cases where the electrometer is inconveniently sensitive, a large condenser, say of 2 or 3 microfarads, may be charged by the induced electromotive force and discharged through a ballistic galvanometer. Fields of 50 C.G.S. units may be readily recognized in this way.

I have already used my method in the study of the curves of saturation, and of residual magnetization of electro-magnets, and propose to apply it in other ways.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For *Electricity's* Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and wherever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all theses submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we should like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not thoroughly clear, we will be pleased to answer any inquiries relating to this matter.

LONDON NOTES.

[From our London Correspondent.]

Gaseous Matter in Crookes Tubes.

On March 25 Mr. A. A. Campbell Swinton read a paper before the Physical Society in London on "The Circulation of Gaseous Matter in a Crookes Tube." He stated that the stream lines within a Crookes tube are investigated by observing the direction and speed of rotation of a mica radiometer mill mounted on a sliding rod so that it can be moved along a line at right angles to both these lines. If the mill is adjusted to a position between the flat plate and the cup electrodes, with its axis sufficiently low to prevent equal and opposite simultaneous action on the top and bottom vanes, it rotates always in the direction indicating a stream from cathode to anode. The speed is greater when the flat plate is the cathode. If, however, the mill is now moved below this line, a point is reached at which rotation ceases, and below this neutral point the rotation is suddenly reversed. Reversal is only to be observed with high degrees of exhaustion; the rotation is never so rapid here as in the first position. The mill rotates, and the reversal may be observed whether cup or plate is made cathode, and the direction of rotation below the neutral point is always opposite to that in the position above it. A small Wimshurst machine is as effective as an induction coil in producing these effects. The experiments were intended to establish the existence, at high degrees of exhaustion, of a true anode stream, i.e., a stream that travels from anode to cathode just in the same manner as the cathode stream flows from cathode to anode. This anode stream is charged positively; it is exterior to the cathode stream; its velocity is less than that of the cathode stream, but its velocity increases as the vacuum is improved. It seemed probable to Mr. Swinton that, at high vacua, some portion of the positive electricity passing through the tube was carried by the positively charged atoms or particles that constitute the anode stream. At lower degrees of exhaustion, the discharge passes through the tube chiefly by interchange of charges from molecule to molecule—a Grothian chain. At the very high vacua, however, when the mean free pass is considerable, there may be, to some extent, a regular and complete circulation of positive and negative atoms, some of which pass from anode to cathode and vice versa, and deliver up their charges, not by interchange, but by direct convection, to the electrodes of opposite sign.

Thermo-Electric Pyrometers.

In a paper read before the same Society by Mr. A. Stansfield, the author said that very serious discrepancies existed between the indications of couples having nominally the same composition; they are too great to be attributed to accidental differences in the constitution of the alloys. Although with platinum alloys coupled with platinum 10 per cent. of iridium gave a more powerful couple than 10 per cent. of pure rhodium, the partial substitution of iridium for rhodium very considerably lowered its thermo-electric power. That result suggested that the change in the thermo-electric power of a metal depended upon the extent to which it was saturated with the alloying metal; thus 10 per cent. either of rhodium or iridium would, per se, more completely saturate the platinum than would 10 per cent. of a mixture of the two metals. The author, after discussing a series of curves derived from his experiments, concluded that thermo-electrically there may be two classes of metals: (1) the ordinary metals, for which the curve representing the first differential of EMF. with respect to temperature is a straight line, and (2) the platinum metals, together with a few, such as nickel and cobalt, for which the curve of that differential multiplied by the absolute temperature is a straight line,

ELECTRICAL EXHIBITION NOTES.

PERSONAL.

Mr. Chas. Chamberlain has been placed in charge of the Press Bureau of the Electrical Exhibition.

HISTORICAL TABLEAUX.

A series of eight illustrative and historical wax tableaux (designed to mark some of the successive stages of electrical development), prepared by Dr. Park Benjamin, Prof. F. B. Crocker and Mr. T. C. Martin, executed and arranged by the Eden Musee Company, will be a feature in the Concert Hall.

The series will include the First Recognition of an Electric Effect, when the Syrian woman, centuries before our era, wonderingly perceived light objects flying to her amber spindle; the Mariner's Compass, ascribed to the Chinese and Italians, but probably to be credited to the Finns, in the eleventh century; the Earth a Great Magnet—William Gilbert explaining the Terrella to Queen Elizabeth, 1600; the First Conductors or Circuits—Stephen Gray, a Charter-House pensioner in London (1720), experimenting on the Conduction of Electricity; the Leyden Jar, showing the bottling of electricity and the terrible shock to Dean von Kleist, canon of the Cathedral in Cumin, in Pomerania, 1746; the Identity of Lightning and Electricity—when Benjamin Franklin drew down the lightning from the skies, 1752; the Beginnings of the Modern Primary Battery or Voltaic Cell, with Galvani's famous frog experiment, 1791, and the Beginnings of Modern Dynamo-Electric Machinery, showing Michael Faraday's famous experiment, 1831.

These tableaux are accompanied by a selection from Dr. Park Benjamin's celebrated library of early philosophical, technical and electrical books, each illustrating some feature or stage of electrical evolutions.

EXHIBITORS SECURED SINCE PUBLICATION OF LAST LIST.

Am. Mutoscope Co., 837 Broadway, New York.
Ashcroft Mfg. Co., 111 Liberty st., New York.
Boston Blower Co., Hyde Park, Mass.
Berlin Iron Bridge Co., East Berlin, Conn., and 95 Nassau st., New York.
Consolidated Safety Valve Co., 111 Liberty st., New York.
Electric Vehicle Co., 1684 Broadway, New York.
Hayden & Derby Mfg. Co., 111 Liberty st., New York.
Kaufman & Alexandre, 1133 Broadway, New York.
Ward Leonard Elec. Co., Bronxville, N. Y.
Montauk Multiphase Cable Co., 100 Broadway, New York.
Mergenthaler Linotype Co., Tribune Bldg., New York.
Manhattan Elec. Storage Battery Co., 636 Broadway, New York.
National Photo. Mach. Co., 85 Beaver st., New York.
National Phonograph Co., 26th st. and Broadway, New York.
Nonpareil Cork Mfg. Co., Gerken Building, New York.
Sims Dudley Defence Co., 120 Liberty st., New York.
Sheridan, T. W. & C. B., 2 Rade st., New York.
Stanley & Patterson, 32 Frankfort st., New York.
Thomson Press Co., John, 253 Broadway, New York.

EXHIBIT OF HEBREW TECHNICAL INSTITUTE.

For some time past, the Hebrew Technical Institute has made a great success of its instruction in the technical branches of electricity as distinguished from the mere teaching in a manual or trade school. Evidences of the ability of the students under Mr. Ker will be given at the Exhibition, where opportunity is being afforded for an excellent display of the electrical engineering skill of the boys. Not only will a number of instruments be entered for the model-making competition, but these will be supplemented by other instruments and apparatus built by them to illustrate principles and phenomena. There will also be a complete small plant in operation, lighting a small house. A collection of blue prints and photographs will also be included.

The New York Electrical Society.

In consequence of the illness of Prof. Sidney H. Short, and the fact that so many of the members of the Society are engaged in active work on the Electrical Exhibition, it has been decided to give Prof. Short's lecture on "The Outlook of Heavy Electric Traction" during the Exhibition.

At the Electrical Exhibition there will be various demon-

strations of scientific phenomena and principles by means of models and apparatus, which will be in more or less continuous operation. As the Society has been entrusted with a great deal of the work of this kind it would like to secure from among its members the help of volunteers to take charge of various features from time to time; the duty will not be heavy, but will be made as light as possible. The first applications will be selected, preference being given, as far as possible, in case there is a large number of applicants, to students of educational institutions. The assignment to duty will be in the hands of a committee of the Society and the Exhibition Company, and the work of such members will be publicly recognized.

Henry Electrical Society.

The 102d meeting of the Henry Electrical Society will be held on Friday evening, April 29, at Columbia University, 116th street and Amsterdam avenue, in the Engineering Building, Room 302.

On this evening Prof. F. B. Crocker will address the members of the Society on "The Design of Circuits for Electrical Distribution," the questions of regulation being illustrated by numerous experiments.

Electric Railway Projects Abroad.

U. S. Consul Schumann writes the State Department from Mainz that it is proposed to change the motive power of the local tramways from horse to electric power, and to extend the trolley to the suburbs. The company contemplating the change also thinks of running a line to Wiesbaden. The Consul says the estimated cost of effecting the change, including the laying of new steel rails in place of the old ones, and erecting and equipping the power station for supplying power for the local lines and for the new lines, is placed at \$400,000. It is further estimated that the cost of maintaining those cars which are to be equipped with the storage system will amount to about \$250 each per annum.

Consul Jackson writes from Cognac: "Proposed electric lights and electric tramways at Angouleme. Communications should be addressed to MM. P. & M. Durand & Co., Lyons, France.

"Proposed electric lights and trolley line for the city of Cognac. Communications should be sent to M. Jules Brisson, Maire de la Ville de Cognac, Charente, France."

Consul Lyon writes from Hiogo (Kobe) Japan: "There are three electric railways projected in this consular district. One is to be 15 miles in length, extending from Kobe to Amagasaki. The company has a capital of 300,000 yen (\$149,000), and the work is to be completed within two years. The time for beginning the work is not fixed. Another line is to be between Amagasaki and Osaka, 5 miles. The company is to have a capital of 300,000 yen (\$149,900). The charter has not yet been granted. Another road is projected to run from Kobe to Arima, 15 miles. The capital is 300,000 yen (\$149,900)."

Machinists' and Engineers' Pocket Manual.

Messrs. Laird & Lee, of Chicago, have just issued in their admirable collection of technical reference books a "Machinists' and Engineers' Pocket Manual," edited by D. B. Dixon, which is the most complete as well as compact work of the kind ever placed on the market. It includes a compilation of rules and solved problems pertaining to steam engines, steam boilers, steam pumps, etc., based on plain arithmetic, and free from algebraic difficulties, together with necessary tables and data of highly practical value in the machine shop, mechanical drawing room and steam power plant. It embraces a Dictionary of Terms used in Steam Engineering and Electricity; the Construction and Operation of Dynamos and Motors; Artificial Refrigeration and Ice-Making; Treatise on the Steam Engine Indicator, Gearing, Shafting, Lathes, Screw Cutting, etc., etc. This illustrated volume of 371 pages, printed on excellent paper and bound in leather, in pocket form, is sure to meet with wide and immediate recognition, as it has been edited by a practical engineer for practical artisans and mechanics, and is up to date in every respect. Leather, with rubber band, and pocket, \$1.00.

LEGAL NOTES.

Judge Smith, at Los Angeles, Cal., on the 15th inst., sentenced A. W. R. Blackman to ten years in San Quentin prison for embezzling \$3,333 from the Los Angeles Electric Company.

The Electric Supply and Construction Company of Savannah, Ga., has been placed in the hands of a receiver by Judge Falligant, on application of the National Bank of Savannah which held a mortgage to cover an indebtedness of \$3,050. There are other mortgages outstanding. Joseph G. Walker was appointed temporary receiver, and for the present the business will be continued under direction of the court.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Baltimore, Md.—The Baltimore City Passenger Railway Company has completed the work of equipping the most important portions of its system, the Red and the White lines, for operation by electricity. A time for the cable cars on these lines to give way to electric cars has not been definitely fixed, the question of power being still under consideration.

Brooklyn, N. Y.—The Brooklyn Elevated Railroad Company has decided to equip its roadbed with the third-rail electric system, in connection with bridge crossing, from the bridge terminal to Bridge street station of the Myrtle avenue line. This will give about 3,000 feet of electric trackage and will be all that the company will do for the present in regard to the change from steam to electricity as the motive power. Power for the operation of the cars will be supplied by one of the trolley companies.

Chattanooga, Tenn.—The Chattanooga, Rome & Southern road officials are figuring on operating electric cars over their line between this city and Chickamauga Park.—The Chattanooga Rapid Transit Company has completed its line as far as Rossville, Ga., and expects to have the line in operation to the park by May 10. This will be the first rapid transit line to the park.

Cincinnati, O.—Charles H. Kilgour of the Consolidated Street Railway Company purchased the Main street line at the sale on the 14th inst., his bid being \$278,000. The road will be re-equipped and put in first-class shape.

Dover, Del.—The Delaware Electric Railway Company, composed of the Dover & Milford Company and the Dover & Bay Shore, has about closed a contract to build a trolley road between Milford, Dover and Woodland Beach. It is expected that work will begin immediately. The entire route, as surveyed, will be 38 miles in length, including turnouts. It will begin at Milford and pass through Frederica, Magnolia, Rising Sun, Camden, Dover and Leipsic, the terminal being at Woodland Beach, where connections will be made with a line of steamers to Philadelphia and Wilmington.

Georgetown, Ky.—The Georgetown Street Railway and ice plant, sold under court orders, has been purchased by C. H. Williams of this city for \$29,000.

Grand Rapids, Mich.—The Consolidated Street Railway Company has awarded a contract to a car fender company in Providence, R. I., to furnish 140 fenders of their make for the company's cars in this city. All the cars will be equipped with them. Manager Johnson states that his company investigated 400 designs of fenders before choosing this kind for use on the cars.

Idaho Springs, Col.—It is reported here that a proposition is on foot for the building of an electric line up Fall river via Alice and Twelve Mile, to connect with the Colorado & Northwestern, building out of Boulder. Henry I. Seeman, with offices in the Equitable building, Denver, is said to have the promotion of the scheme, and with him as a backer George W. Crocker, the railroad magnate.

Indianapolis, Ind.—The "Sentinel" says: "The Michigan, Indiana & St. Louis Electric Railway Company, with headquarters in Chicago, has planned to begin work within two weeks on the construction of a line of electric railway eighty miles in length in the State of Indiana. Construction is to be started at Monticello and is to progress both ways toward the terminal points, which are to be about forty miles from Monticello. The road is projected to do a general passenger and freight business. The principal freight traffic expected is transportation of farm products raised in the territory along the line. A capital of \$275,000 is represented in the investment. The power houses will be at Winamac and Monticello."

Jefferson, O.—A fifty-year franchise has been granted the Pennsylvania & Ohio Railway Company to build and operate an electric line from Conneaut westward, connecting with the Cleveland, Painesville & Eastern. The road must be finished by July 1, 1900, and it must pay the county \$500 annually for crossing the high level viaduct at Ashtabula.

Martinez, Cal.—The supervisors have granted J. S. Bullock of the Blue Lakes Electric Company a franchise to erect poles and wires for an electric road in this county. The line will run to Oakland and San Francisco.

New York.—The Metropolitan Street Railway Company intend to change the motive power of the Broadway line from cable to the underground trolley as soon as they can get the consents of a majority of property owners. The system used will be the same as that now in operation on the Madison, Lenox and Amsterdam avenue lines.

Norfolk, Va.—The Norfolk & Ocean View Railway which was recently acquired by the Norfolk Street Railway Company, passed into the hands of its new owners on the 16th. The purchase price of \$329,000 was paid in full. The road was later reorganized, J. Lancaster Williams, of Richmond, being chosen as president.

Oshkosh, Wis.—The war scare has brought the Oshkosh-Neenah interurban electric road affairs to a standstill and the outlook for securing any interurban electric road connecting with Oshkosh is somewhat dubious. J. K. Tillotson says that the unsettled condition of the bond and stock market is largely responsible for the delay in the construction of the contemplated roads.

San Bernardino, Cal.—The street car company has thrown up its franchise and will, it is said, make a present of the tracks to any one who wishes to take them. It is understood that C. R. Lloyd of San Francisco will get possession of the tracks and utilize them for an electric car line.

San Antonio, Tex.—The San Antonio Street Railway Company has posted a notice that any employees of the company who may enlist in active volunteer services will, upon their return from the war, have their positions, and during the time they are in actual service their wages will continue, and will be paid to their families or dependent ones.

St. Louis.—The ordinance granting a franchise to the Central Traction Company which was passed over the mayor's veto authorizes that company "to construct, operate and maintain a single and double track passenger railroad on, over and along and across certain streets, avenues, highways, railways, bridges and city blocks, in the city of St. Louis, and to operate its line of railroad by electric power, and to run over the tracks of other roads, and to acquire and convey by lease, purchase or sale its own property and franchises, or the property and franchises of other street railway companies, in the city of St. Louis, and to operate same."

Wilmington, Del.—President Clarence M. Clark, of the trolley systems of Wilmington and Chester, Pa., says that the right of way for the connecting link between the two cities has been secured, and laying the tracks will begin this week. When completed this will connect Philadelphia and Wilmington by trolley.

LIGHTING PLANTS.

Atlantic City, N. J.—J. Rothermel, of Reading, Pa., was awarded the contract to furnish 175 or more electric lights to the city for a term of five years. He bid \$105 per lamp against \$127 by the company at present holding the contract. Rothermel gave the city a certified check for \$2,000 as an evidence of good faith, and also agreed to enter a bond to erect and have an electric light plant in operation in the city within 90 days.

Columbus, O.—When bids for the equipment of the municipal electric light plant were opened on the day set it was found that there were no bids for a dynamo, and it was suspected that there was some understanding among the bidders in the interest of the local light company. The board of works held a meeting last week to discuss the matter and a number of representatives of electrical companies who were present assured the board that bids for a dynamo would be submitted when the contract is to be awarded, May 4.

Evansville, Ind.—The People's Electric Light & Power Company has installed a power plant to furnish current for motors, fans, etc., in addition to the lighting plant.

Flint, Mich.—The receiver of the defunct Fenton State Bank has been authorized by the court to sell the Fenton electric light plant to Fayette L. Thompson of Lansing for \$7,000.

Greensboro, N. C.—S. H. Houghton of New York has offered to build an electric street railroad here and operate it, provided he can get the contract for furnishing electric lights.

Grand Forks, N. D.—The temporary injunction brought to restrain the city from buying and operating an electric light plant for street lighting purposes was dissolved by Judge Fisk in the district court April 15. An appeal will be taken, but the electric plant will be completed at once.

Helena, Mont.—The power plant of the electric light company at White Sulphur Springs was burned on the night of the 11th inst. It was in the hands of a receiver and was to be sold on the 12th. What was left of the plant was sold for \$200.

Houston, Tex.—Blake Dupree, receiver for the Citizens' electric light plant, says that while negotiations of settlement between the light company and the insurance companies have not been definitely closed, the general terms of settlement have been agreed upon, and that when the compromise is consummated the electric light company will proceed to construct in this city a very much superior plant to the one that was recently destroyed by fire.

Hudson, Mass.—This town owns a municipal lighting plant, but has concluded that it cannot sell electricity to consumers at a price on which it can make a profit, and so has petitioned the Gas & Electric Light Commissioners for permission to sell for less than cost. Its present price is twenty cents a kilowatt hour.

Middleport, O.—The council has granted an electric light franchise to George Cowie of Middleport and George Pfarr of Pomeroy.

Pasadena, Cal.—Owing to insufficient publication of advertisements for the sale of the electric light and power franchise, the opening of the bids was forbidden by the city attorney. The city clerk was ordered to readvertise the franchise, bids for the same to be received up to noon on May 16.

Randolph, Vt.—Amid the booming of cannon, the ringing of bells and the blowing of whistles, the electric lights for this village were turned on for the first time on the night of the 14th inst. There was a large crowd of people present from surrounding towns.

Rogers City, Mich.—At a meeting of the village council last week a franchise was granted to S. Baker & Co. for an electric light plant. It is to consist of twenty-two lamps or more of thirty-two candle power and is to continue for ten years.

Tiffin, O.—The city gas plant, which a few months ago was bid in by the Northwestern Gas & Electric Company, is again in the hands of the city, the company failing to pay the \$80,000 at which they bid it in. The Northwestern Company claim to have been unable to secure the money on account of pending war clouds. This is the second time the plant has been bid in and then not taken and it will undoubtedly be readvertised.

Washington, D. C.—An amendment to the Naval Appropriation bill providing for an electric light and power plant at the naval station, Port Royal, S. C., at a cost of \$20,000, was adopted in the Senate on the 21st inst.

Winoski, Vt.—There is earnest talk here of establishing an electric light plant and operate it from a neighboring water power.

TRANSMISSION PLANTS.

Charlestown, W. Va.—J. C. Hanger and R. F. Thompson of Pennsylvania were here a few days ago with a view of purchasing the power of the Harper's Ferry Paper Company at Harper's Ferry to establish an electric light plant to light that place, Charlestown and other towns in Jefferson County. It is said that 5,000 horse power could be developed.

Columbus, Ga.—The Columbus Power Company has practically closed a contract for the construction of a dam at Lovers' Leap, on the river. The contract is an important one and will call for an expenditure of over \$100,000. The work will be pushed rapidly during the summer while the river is at its lowest stages. Immediately following the completion of the dam, the finest electric plant ever constructed in the South will be put in, furnishing almost unlimited power, which will be sold to manufacturing enterprises in large or small quantities. The building of this plant is likely to insure the construction of several large manufacturing plants in Columbus.

MANUFACTURING, ETC.

Boston, Mass.—By a fire on the 19th inst., in the Tilden block in which the General Electric Company had a quantity of electric supplies stored, that company's loss was between \$3,000 and \$4,000.

New Orleans.—Correcting a statement of the "Times Democrat" that there was not a sugar house in the State using electric power, a correspondent of that paper writes from Baton Rouge to say that Cinclare plantation, in West Baton Rouge, is using electricity. It has two electric hoists that handle 25 tons each, and the bagasse blower, four 30-inch centrifugals and the laundry are run by electricity. Next season the mill will be fed by means of electrical apparatus.

Pittsburg, Pa.—The "Times" states that "the contract for an electric power transmission plant for the falls of Monte Alto and Tlalnepanla rivers, near the city of Mexico, has just been awarded to G. & O. Braniff & Co., representatives of the Westinghouse Electric & Manufacturing Company in Mexico. The plant will be the largest and most important power transmission project ever contemplated in the republic and all the electrical machinery will be manufactured in East Pittsburg."

COMPANY MATTERS.

St. Cloud, Minn.—The stockholders and the bondholders of the Water, Light & Power Company of this city, having reached a satisfactory agreement, the properties concerned have been taken out of the hands of the receiver, Charles S. Benson, and the old officers will resume the management of affairs until the stockholders meet to elect a new board of directors.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—Elaborate and beautiful designs have been completed by Commissioner Isaac G. Perry for electrical fixtures in those portions of the Capitol which have been completed. This includes electroliters for the eastern and western approaches, for the north and south porticoes, for the grand western staircase and for lobbies in the building. Those for the exterior will be of bronze and the interior of brass. The eastern approach will be standards of massive design, each holding fifty incandescent lights. On the second landing of the steps the electroliters will be symbolical—eagles, the coat of arms of the United States and of the State of New York, the seal of the State and other designs. On the third flight of steps all the fixtures will be very graceful in design, carried out in the Romanesque, and arranged for thirty lights. On the new western approach, bronze electroliter standards with forty lights each will surmount the newel posts; handsome foliage figures will adorn the whole, which will be strictly in keeping with the rest of the work. One of the most noticeable features will be the lighting of the staircase by large clusters of incandescents to be hung over the balustrade. When lighted the display will far surpass any ever designed for any public building and will make the Capitol a perfect blaze of light.

Schenectady, N. Y.—The General Electric works has presented \$100 to each of the military companies in Schenectady for furnishing the quarters at the armory which is now being constructed.

PERSONAL AND MISCELLANEA.

The directors of the Columbia Railroad Company, Washington, D. C., have elected Nathaniel Wilson president of the company to fill the vacancy caused by the death of R. F. Baker.

The Chicago "Inter-Ocean" states that a hospital car, to cost \$10,000, is being built for the Missouri, Kansas & Texas. The car will be provided with a drug store and operating room and will make regular trips over the different lines of the system for the purpose of bringing sick and wounded patients to the hospital at Chicago.

Hermann S. Hering, associate in electrical engineering in the Johns Hopkins University, Baltimore, is conducting the graduating class in the electrical department on a tour of inspection through several large electrical plants in New York State, New Jersey and Philadelphia. The students are taken on a similar tour each year.

Dr. Emma Sutro-Merritt, eldest daughter of Adolph Sutro, will probably be elected director and president of the Sutro Electric Railway Company of San Francisco. O. F. Von Rhein, the present manager and president, has resigned. Dr. Merritt is a graduate of Vassar College and the Toland Medical College.

Rychnowski, an electrician of Lemberg, Austria-Hungary, claims to have discovered an electric fluid, which he calls "electroid." He obtained it by electrolysis; but it is not identical with electricity. Its effects are declared to be startling, producing light and causing Geissler tubes to emit fluorescent rays. It works photochemically, rotates objects in mid air, produces whirlpools in water and kills bacteria. Metal and glass can be charged with electricity by it and the magnetic needle changes direction under its influence.

Otto Bahr, one of the engineers at the Mead electric light plant at Marion, Ind., resigned suddenly a few nights ago, and it was impossible to get a man to take his place. To keep the plant running and supply the city with light, Mrs. Zack Parvis, the wife of the other engineer, stepped into the breach. She did the work with the same accuracy as her predecessor, and many noticed the unusual brilliancy of the Mead lights. It was because a woman was running the engine that drove the dynamo. Mrs. Parvis has observed her husband at work, and as a result is almost as good an engineer as he. If pressing household duties did not require her attention Mrs. Parvis would likely accept a permanent position as assistant engineer in the light plant.

Perhaps one of the oddest things in all Southern California is a street-car in Ontario, San Bernardino county, says the San Francisco "Call." This car is not run by electricity or steam, nor is it drawn by a cable. Every morning it can be seen standing near the depot of the Southern Pacific Railroad waiting for the incoming train. It is long, broad, and filled with little seats, such as are found in steam cars, and a broad aisle down the center. Two mules are harnessed to the front of the car. In comes the railroad train and off goes the car up Euclid avenue, the principal thoroughfare of Ontario. Euclid avenue is 200 feet wide and along the sides are rows of pepper and palm trees. Directly in the center of the street is the car track. On each side is a broad strip of green, bounded by a row of trees. This avenue is seven miles long and it is a true grade. The altitude at the head of the avenue is 1,400 feet above the foot of the avenue. At the terminus of the road the driver pulls from under the back of the car a square platform, places the mules upon it, releases the brake and away goes the car down the long, gentle grade, moving only by gravity, thus giving these two tired mules a free ride, which they enjoy as much as any of the passengers. The grown people as well as the children crowd out upon the back platform and feed the happy-looking mules with grass and candy.

RECENT COMPANY ELECTIONS.

Market Street Railway Company, San Francisco, Cal.—President, H. E. Huntington; vice-president, Charles Holbrook; second vice-president, Alvinza Hayward; treasurer, N. T. Smith; secretary, J. L. Wilcutt; directors: H. E. Huntington, Charles Holbrook, Alvinza Hayward, Charles G. Lathrop, I. W. Hellman, George Crocker, F. S. Doughty, N. T. Smith and J. L. Wilcutt.

Port Deposit Electric Light Company, Port Deposit, Md.—President, R. E. McClenahan; secretary, John McClenahan; treasurer and superintendent, D. G. Wilson.

Raleigh Street Railway Company, Raleigh, N. C.—President, William J. Andrews; vice-president, A. A. Thompson; secretary and superintendent, Charles C. Johnson; directors: J. H. McAden of Charlotte, J. H. Outler of Boston, A. A. Thompson, William R. Tucker, Julius Lewis and Robert T. Gray.

COMMERCIAL PARAGRAPHS.

Educate Your Bowels With Cascarets.
Candy Cathartic, cure constipation forever.
10c, 25c. If C. C. C. fail, druggists refund money.

We are in receipt of the latest illustrated catalogue and price list of the Lunkenheimer Company of Cincinnati, O. As is well known, this company manufactures a high grade of brass and iron valves, injectors, whistles, lubricators, oil and grease cups, and steam specialties in general. Only the very best of materials enter into the construction of their goods, whose unequalled design, combined with unexcelled workmanship, bespeaks for them the patronage of all users of first-class articles. During the year many important additions have been made to their plant, so that at the present time the Lunkenheimer Company has unequalled facilities for manufacturing the various articles in its line and also special work of a like character. Their New York office is situated at 26 Cortlandt street and their office in London, Eng., is located at 8 5 Great Dover street.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c. If C. C. C. fail to cure, druggists refund money.

The Electric Appliance Company, Chicago, have increased their line of enclosed Upton Arc Lamps by the introduction of a new enclosed lamp for alternating work. This lamp is giving very satisfactory results and gives promise of being equal in every respect to the direct current enclosed lamps. The Electric Appliance Company have one of these lamps burning in their store and it has been commented on favorably by all who have watched its operations.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

INCORPORATIONS.

Holcomb & Green Electric Company, Springfield, Ill.—to operate electric light plant, manufacture electric machinery, etc. Capital stock, \$5,000. Incorporators: Eugene Holcomb, H. S. Green and C. F. Adams.

The Farmington Electric Light & Ice Company, Farmington, Mo. Capital stock, \$21,000. Incorporators: D. O. Johnson, Charles E. Schwarz and O. R. Webb.

The Syndicate Construction Company, New Brunswick, N. J.—to construct and operate trolley lines in Middlesex, Somerset, Union, Mercer, Burlington and Camden Counties, N. J. Capital stock, \$40,000. Incorporators: Gottfried Krueger, Edward H. Kadel and Andrew Kadel.

The Carnegie & Washington Street Railway Company, Carnegie, Pa.—to build a trolley railway in Carnegie to connect with the Pittsburgh, Union & Massachusetts Street Railway. Capital stock, \$18,000. President A. S. Maxwell, Allegheny; directors: H. K. Harlow, A. M. O'Brien, G. C. Pugh, R. H. McLarn, Pittsburg.

The Standard Electric Magnetic Power Company, Martinsburg, W. Va.—to operate an electric plant. Capital stock limited to \$5,000. Incorporators: R. Miles Robinson, W. L. Teter, F. S. Seaman, M. L. Ritter and F. C. Stalnacker.

The Toronto Electric Motor Company, Toronto, Can.—to acquire the business now carried on by the Toronto

Electric Motor Company and the Thompson Electric Company of Hamilton. Capital stock, \$50,000. Incorporators: John Campbell McLaughlin, Hiram M. Albertson, George McLaughlin, John W. Thompson and William A. Turbayne, of Toronto.

The South Bend Electric Company of South Bend, Wash., has filed articles of incorporation at Olympia. Capital stock, \$40,000.

The Highland Grove Traction Company, McKeesport, Pa., to build a short trolley road. Capital stock, \$12,000. President, T. H. Bowman, McKeesport; directors: S. M. Bowman, Arthur B. May, McKeesport; W. O. Cronmeyer, Monts Wolf Demmler.

The Pelton Construction Company, Alexandria, Va., to buy and sell real estate, buy and sell machinery, furnish power for railroads, corporations, etc. Capital stock, \$50,000. President, J. H. Ingram of New York; agent in Alexandria, Gardner L. Booth.

The Syracuse, Skaneateles & Moravia Railroad Company to construct an electric road forty miles in length through the counties of Cayuga and Onondaga, with the village of Moravia as its southern terminus and the city of Syracuse as its northern terminus. Capital stock, \$1,000,000. Directors: Wing T. Parker, Thomas W. Downing, John Andrews and Joseph Parker, of Moravia, and Henry J. Hibbard, of Skaneateles.

The Herkimer County Light & Power Company of Herkimer, N. Y., with a capital of \$100,000, has been formed by the consolidation of the Herkimer Gas Light Company of Herkimer, the United Gas & Electric Light Company of Little Falls and the Ilion & Mohawk Gas Light Company of Ilion. The directors are William F. Cochran and Alexander S. Cochran of Yonkers, George E. Weed, Maitland F. Griggs, Thomas E. O'Shea, Henry Stanton, Robert P. O'Shea and James P. O'Shea of New York City, and Thos. Ringwood of Ilion.

The Intercolonial Hydraulic Company, New York City, to develop, lease and sell hydraulic and electric properties. Capital stock, \$50,000. Directors: Henry F. Whalen, Russell H. Landale, Ernst W. Cooke, New York; S. F. Smith, York, Pa.; James M. McCarthy, Montreal, Can.; Archibald K. Cook, Quebec, Can., and Charles E. Hathaway, Providence R. I.

Redfield Brothers, New York City, to do general printing, electrotyping and engraving. Capital stock, \$50,000. Directors: Taylor I. Redfield of New York, Judd H. Redfield and Charles M. Redfield of Brooklyn.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 19, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 602,495. Electric Contact-Shoe. William M. Brown, Johnstown, Pa., assignor to the Johnson Company, Lorain, Ohio. Filed Nov. 14, 1897.
- 602,584. Electric Railway. Hosea W. Libby, Boston, Mass. Filed Dec. 10, 1894.
- 602,678. Traveling Contact for Underground Electric Railways. Griffin B. Coleman and Joseph W. Duggan, Washington, D. C. Filed Nov. 2, 1897.
- 602,746. Street-Indicator. Edgar J. Hall, St. Louis, Mo. Filed Nov. 8, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 602,557. Alternate-Current Meter. Clarence P. Feldmann, Cologne, Germany, assignor to the Helios Electric-Licht-Actien-Gesellschaft, same place. Filed Dec. 21, 1897.
- 602,596. Electrical Apparatus. Horace H. Eldred, Brooklyn, N. Y., assignor to Henry B. Metcalf, Pawtucket, R. I. Filed April 4, 1896.
- 602,709. Apparatus for Reducing Electric Currents and Voltage. Alexander F. Vetter, Long Island City, N. Y., assignor, by mesne assignment, to the Meyrowitz Manufacturing Company, Ridgefield, N. J. Filed Sept. 8, 1895. Renewed Nov. 13, 1897.
- 602,757. Electric Switch. Arthur G. McPherson, Highland Park, Ill. Filed May 1, 1897.
- 602,781. Apparatus for Controlling Electric Motors. Arthur J. Stropher, London, England, assignor to the Siemens Brothers & Company, Limited, same place. Filed Feb. 16, 1898.

SIGNALS AND SIGNALING APPARATUS.

- 602,484. Signaling Device for Railway-Cars. Frank W. Diehl, Detroit, Mich. Filed Sept. 28, 1897.
- 602,792. Railway Signaling System and Apparatus. Henry Bez-r, New Rochelle, N. Y. Filed Dec. 3, 1895. Renewed Feb. 25, 1898.

MISCELLANEOUS.

- 602,463. Trolley-Wire Hanger. William A. McCallum, Cincinnati, Ohio. Filed Aug. 16, 1897.
- 602,527. Electrical Measuring Instrument. Herbert W. Sullivan, London, England. Filed Nov. 6, 1896.
- 602,548. Electric Controller for Gas-Regulators. William K. H. Williams and Paul Selter, San Francisco, Cal. Filed May 13, 1897.
- 602,564. Insulated Pipe-Coupling. George Peeples, Philadelphia, Pa. Filed June 19, 1896. Renewed Oct. 5, 1897.
- 602,576. Bracket for Insulators, etc. John R. Fletcher, Dayton, Ohio. Filed Jan. 4, 1896. Renewed Feb. 2, 1898.
- 602,747. Process of Smelting Phosphorus. Charles K. Harding, Chicago, Ill. Filed April 5, 1897.
- 602,815. Electric Furnace. George G. Clarke, Galveston, Tex., assignor to Sylvain Blum, Hillary Eldridge and Daniel Johnson Clark, same place, and Sam Lazarus, Sherman, Tex. Filed Feb. 8, 1897.

WANTED FOR THE UNITED STATES NAVY.

Qualified men for the ratings of **ELECTRICIAN**. Applicants must be capable of performing all duties pertaining to the care, preservation, and manipulation of a ship's electric lighting plant and its appurtenances, together with all other electrical appliances; they must also be physically qualified. First enlistment is made in the rating of Electrician, second class, (\$35 per month,) with possibility of future advancement to Electrician, first class, (\$40 per month), and Chief Electrician, (\$50 per month). In addition to the pay stated, there is a ration allowance of 30 cents per day. Enlistments in this rating are made only at the Navy Yard, Brooklyn, N. Y.

TELEPHONE AND TELEGRAPH.

At a recent meeting of the joint committee of the public order, health and police and public building committees in New Orleans, a communication from the People's Telephone Company was read, in which they accepted the privileges and franchises under ordinance No. 10,752, C. S., and stated that they intended to avail themselves of the provisions of the ordinance. They obligate themselves to begin the actual construction of their telephone system within sixty days, and to complete it between Julia and Esplanade, Delta and Basin streets within one year thereafter. They have already secured the plans and specifications for the work, and are ready to begin at once. The communication was accompanied by a map showing the territory through which the proposed system will pass, all of which were referred to the city attorney and city engineer.

A number of Barnesville, O., people recently witnessed a novel and unusual scene in the deliberate destruction of nearly \$3,000 worth of property by its owners. A bonfire was made in that town of 157 telephones, formerly the property of the independent telephone company of Barnesville, which a few weeks ago sold out to the Bell people, who have adopted the policy of thus destroying the telephones and apparatus of rival independent companies who have fallen into their clutches. A big crowd was on hand to see the novel bonfire, and the Bell officials were offered all sorts of prices for the telephones. They flatly refused all offers and applied the matches. The boxes were worth about \$18 each.

The Iowa Telephone Company expects to put in this summer new copper metallic circuits over nearly 900 miles of territory. The longest new line scheduled is from Dav enport to Des Moines via Washington, Oskaloosa and Indianola. Other lines planned are: Burlington to Ottumwa, 72 miles; Grinnell to Oskaloosa, 81 miles; Waverly to Charles City, 30 miles; Slouss City to Orange City, 45 miles; Independence to Decorah, 74 miles; Marion to Monticello, 35 miles; Webster City to Ames, 14 miles; Osceola to Afton, 26 miles; Wayland to Mt. Pleasant, 25 miles; Den nison to Missouri Valley, 55 miles; Pringhar to Cherokee, 35 miles; Cherokee to Washington, 20 miles.

The St. Paul *Globe* says: "The jobbers' union of St. Paul is interested in the question of telephone competition and at a meeting held a month ago a committee was appointed to look into the affairs of the Mississippi Valley Telephone Company and ascertain whether it was a company meriting the confidence of the business community. At a meeting of the union Saturday, the committee endorsed the company in a report which was presented to the union and adopted."

We learn from the Des Moines, Ia., *Leader* that the recently organized Central Telephone Company will at once begin the construction of a line from Des Moines to Oskaloosa. The incorporators of the new company are all interested in the Mutual exchange in Des Moines, and arrangements have been made to operate its lines in conjunction with it. Manager Bartlett, of the Mutual, has resigned his position to engage actively in the telephone construction business. He will be succeeded by W. K. Hind, of Fairfield, a telephone man of wide experience.

It is reported that some of the leading interests in the Metropolitan Traction Company have become interested in the new telephone company in opposition to the existing telephone company in New York, and that the work of laying subways will soon commence. It is said to be the purpose of the company to construct an extensive system of subways. The new company is said to already have applications enough for the lease of wires to form a considerable part of its proposed revenue.

The Standard Telephone Company of Newtown, Pa., organized with a capital stock of \$10,000 for the purpose of transacting local business, proposes to erect a line connecting Newtown, Doylestown, Bristol and other points in the county. The officers are H. C. Worstall, president; Watson P. Church, secretary; Edward T. Hicks, treasurer. The board of directors is composed of the officers named and Harry A. Smith, Thaddeus Kenderdine, Clayton Keller and George C. Worstall.

The Automatic Telephone Service Company has made application for a franchise to the city council of Rochester. It asks for the right to establish and maintain a system or systems of telegraph or telephone for public or private use in the city of Rochester, and to construct conduits, erect poles, place wires, conductors, cables and all appliances necessary to the successful conduct of its business.

The men interested in the Philadelphia Standard Telephone Company are disposed to go on with the suspended work in Philadelphia if means can be obtained. The

company has a valuable franchise and considerable work has been done in the construction of conduits, etc., but funds are lacking, and efforts are to be made to interest capitalists in the enterprise. The war, however, interposes an obstacle in this direction which it will be difficult to surmount.

After the Railroad Commission made an order reducing telegraph rates to 15 cents for a ten-word message over the Western Union lines in North Carolina, that company secured an injunction and filed complaint. The Railroad Commission then filed its answer. The Western Union Co. on the 15th inst., at Raleigh, filed a replication in the United States Circuit Court saying the answer made by the commission through its attorney is "scandalous and impertinent" and begs the court to rule the answer out.

The Standard Telephone Company has completed its main underground conduits at Atlanta, Ga. The work of constructing the plant is being done by the Southern Standard Telephone Construction Company of Philadelphia. The officers of the Atlanta Standard Telephone Company are: President, Simon Baer; secretary and treasurer, Joseph S. James. Among the directors of the company are Charles G. Wetter, Philadelphia; G. F. Baer and J. W. Nelms of Atlanta.

The Bunker Hill (Ill.) Telephone Company has organized with the following board of directors: Adolf Bumann, Charles E. Drew, C. J. Jacoby, James Jencks, John Neil. The officers are: Adolf Bumann, president; C. J. Jacoby, vice-president; Charles E. Drew, secretary and treasurer. The company expects to have the line open for business June 1.

The Chester County Telegraph and Telephone Company has been chartered at Harrisburg, Pa., and will open exchanges in Malvern, Coatesville, West Chester, Oxford, Phoenixville and other places. Over one hundred subscribers have already been secured at Phoenixville. Low rates will be a feature of the new company.

The Citizens' Long-Distance Telephone Company was organized at Lansing, Mich., on the 13th inst., for the purpose of building a line from Lansing to Flint. The incorporators are Peter C. Burns, of Chicago; Samuel C. Higgins and Frank Marsh, of Saginaw, and Marsellies L. Joslyn, of Woodstock, Ill.

Judge Simonton has signed the decree ordering the sale of the Mutual Telephone & Telegraph Company, which was organized as a rival of the Bell in Charleston, S. C. The sale is ordered to take place on May 8. The upset price is \$15,600.

A special committee of the city council of Chattanooga, Tenn., has under consideration the petition of a Mr. Coleman, of Columbia, Tenn., for a franchise enabling him to establish a telephone exchange in Chattanooga.

The Supreme Court of the United States has granted the application for a writ of certiorari in the case of the city of Richmond, Va., against the Bell Telephone Company. It may be two years before the case is reached.

The capital of the New Ulm (Minn.) Telephone Company is to be increased to \$20,000 and its lines extended so as to include Mankato, Morgan, Redwood Falls, Lamberton and Tracy.

The line of the Nebraska Telephone Company to Tecumseh has been completed and connections made with Omaha and Lincoln.

New Companies Incorporated.

The Lake County Telephone Company, Libertyville, Ill. Capital stock \$2,500. Incorporators: James Turnock, Joseph A. Seyl and T. Degen.

The Somerset Telephone Company, Madison, Me. Capital stock, \$2,000. President, T. H. Spear.

The Gapland Telephone Company, Gapland, Md.—to build and operate telephone and telegraph lines. Incorporators: John Ahalt, Hamilton W. Shafer, George C. Huffer, George S. Huffer and T. B. Biser.

The New Long-Distance Telephone Company, Indianapolis—to build lines connecting Indianapolis with the independent lines throughout Indiana. Capital stock, \$1,000,000. Incorporators: S. P. Sheerin, Indianapolis, president; A. H. Nordyke, D. M. Parry and Harry B. Gates, Indianapolis; Alexander F. Ramsey, Crawfordville; Daniel E. Dougherty, Louisville, Ky.; George W. Beers, Fort Wayne, Ind.

The Sabetha Telephone Company, Sabetha, Kan.—to establish a telephone system in Sabetha connecting with adjacent towns. Capital stock, \$1,800. Directors: D. D. Doolittle, G. M. Bunker, Harry Reding, Elizabeth Doolittle, Annie M. Bunker and Helen E. Reding.

APRIL 27, 1898.]

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: *ert.* indub., certificate of indebtedness; *coll.*, collateral; *cons.*, consolidated; *const.*, construction; *conv.*, convertible; *com.*, common; *deb.*, debentures; *exten.*, extension; *gen.*, general; *g.*, gold; *guar.*, guaranteed; *inc.*, income; *imp.*, improvement; *pd.*, paid; *pdf.*, preferred; *mtg.*, mortgage; *tr.*, trust; *A.*, annually; *S.*, semi-annually; *Q.*, quarterly; *A. & O.*, Apl. and Oct.; *F. & A.*, Feb. and Aug.; *M. & S.*, May and Sept.; *J. & D.*, July and Dec.; *J. & J.*, Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.
	Par	Authoriz'd	Issued.			
Albany, N. Y.—Apr. 25:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1% Q, Feb. '98.	145	147 1/2
Troy City Railway Co.	100	2,000,000	2,000,000	1% Q, Dec. 10, '97.	68	69
Traction Co. (Saratoga)	100	50,000	50,000			
Allentown, Pa.—Apr. 25:						
Allentown & Lehigh Val. Trac. Co.	100	4,000,000	1,500,000		15	
Bridgeport, Conn.—Apr. 25:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1% Aug., '97.	45	60
Baltimore, Md.—Apr. 25:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5% S., July 2, '97.	71	72
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2% S., Jan. 15, '98.	22 1/2	23
Central Ry. Co. of Baltimore City	50	800,000	800,000	6% A. Dec., 1897.	80	82 1/2
Boston, Mass.—Apr. 25:						
New England Street Ry.	25	5,000,000	1,081,925	1% Q, Jan. 15, '97.	10	13
North Shore Traction Co.	100	4,000,000	4,000,000		67	72
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6% S. A. & O.	79	80
West End Street Ry. Co.	50	10,000,000	9,085,000	4% S., Oct., '97.	102	102 1/2
West End Street Ry. Co. 8% pfd.	50	6,400,000	6,400,000	4% S., Oct. 1, '97.	53	51
Boston Elevated R. R.	100	10,000,000				
Brooklyn, N. Y.—Apr. 25:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2% Feb. 1, 1898.	185	195
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000		35 3/4	35 3/4
Brooklyn Heights Railroad	100	200,000	200,000		198	200
Brooklyn City RR.	100	12,000,000	12,000,000	2% Q, Jan., '98.	198	200
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000		185	
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1% Q, Oct. 1, '97.	45	48
Kings County Elevated	100	4,750,000	4,750,000		37 1/2	
Kings County Traction Co.	100	4,500,000	4,500,000	1% July 26, '97	74	80
Nassau Electric Railroad	50	6,000,000	6,000,000			
Atlantic Avenue Railroad	50	2,000,000	2,000,000			
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000			
Buffalo, N. Y.—Apr. 25:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000		58	60
Buffalo Railway Co.	100	8,000,000	5,370,500	1% Q, Dec., '97.	78	80
Columbus O.—Apr. 25:						
Columbus Street Railroad	100	8,000,000	8,000,000	1% Q, Feb., '98.	47	48
Columbus Central Street Railroad	100	1,500,000	1,500,000			
Charleston, S. C.—Apr. 25:						
Charleston City Ry. Co.	50	100,000	100,000	3% S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000			
Chicago, Ill.—Apr. 25:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3% Q, Dec. 31, '97.	215	220
Chicago & South Side R. T. RR.	100	10,823,800	10,323,800		10 1/2	10 1/2
Lake Street Elevated RR.	100	10,000,000	10,000,000		8 1/2	8 1/2
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000			
Met. West Side El. const. stk.	100	15,000,000	2,500,000			
North Chicago Street RR.	100	10,000,000	6,600,000	8% Q, Jan., '98.	201	203
North Chicago City RR.	100	500,000	249,900			
South Chicago City Railway	100	2,000,000	1,603,200			
West Chicago St. RR. Co.	100	20,000,000	13,189,000	1% Q, Feb., '98.	87 1/2	88 1/2
Chicago West Div. Ry. guar.	100	1,250,000	624,900	35%		
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000	5% S.		
Cincinnati, Ohio.—Apr. 25:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000		20	
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2% Q, Feb., '98.	75	
Cincinnati, Newport & Gov. St. Ry.	100	4,000,000	3,500,000		23	25
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1% Q, Jan., '98.	112 1/2	113
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1% Q, Jan., '98.		
Cleveland, Ohio.—Apr. 25:						
Arion, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000	3% Jan., '98	39	40
Cleveland City Ry.	100	8,000,000	7,600,000	3% Q, Oct., '97.	55	60
Cleveland Electric Ry.	100	12,000,000	12,000,000	3% Q, Oct., '97.	50	53
Detroit, Mich.—Apr. 25:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000		100 1/2	
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5% July, '98.	175	
Rapid Railway Co.	100	250,000	250,000			100
Detroit Electric Railway	100	1,000,000	1,000,000			
Wyandotte & Detroit River Ry.	100	250,000	200,000		100	110
Dayton O.—Apr. 25:						
City Railway Co.	100	1,500,000	1,470,600	1% Q, Jan. 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000	1% Q, Jan. 1, '98	140	145
People's Street Railway	100	1,100,000			100	
Hartford Conn.—Apr. 25:						
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000	3% S., Jan., '98.	140	
Hartford & West Hartford RR.	100	1,000,000	247,000			
Holyoke Mass.—Apr. 25:						
Holyoke Street Ry. Co.	100	400,000	400,000	3% A., Jan., '98.	200	205
Hoboken, N. J.—Apr. 25:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8%, 1892.	70	
Indianapolis, Ind.—Apr. 25:						
Citizens' Passenger Ry.	100	5,000,000	5,000,000		24	25
Lancaster, Pa.—Apr. 25:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000			
Lancaster & Col. Electric Ry.	100		87,500			
West End Street Railway	100					
Louisville, Ky.—Apr. 25:						
Louisville Ry. com.	100	4,000,000	3,500,000	1% Q, Oct., '97.	45	50
Louisville Ry. 5% pfd.	100	2,500,000	2,500,000	2% S., Oct. 1, '97.	90	100
Minneapolis, Minn.—Apr. 25:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000		14	20
Twin City Rapid Transit 7% pfd.	100	8,000,000	1,714,200	1% Q, Jan., '98.		100
Montreal, Canada.—Apr. 25:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8% S. M. & N.		244 1/2
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1% S. J. & J.	87 1/2	87 1/2
Memphis, Tenn.—Apr. 25:						
Memphis Street Railway Co.	100	500,000	500,000		15	
New Haven, Conn.—Apr. 25:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4% S., Sept., '97.	60	
New Haven Street Railway Co.	100	1,250,000	1,000,000	2% A., July '98.	60	80
New Haven & Centerville	100	700,000	300,000			
Winchester Avenue RR.	25	1,000,000	600,000		40	42
New Orleans, La.—Apr. 25:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4% S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1% Q, Jan., '98.	123 1/2	126
New Orleans Traction Co. com.	100	5,000,000	5,000,000		8	8
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000		30	30
Crescent City RR.	100	2,000,000	2,000,000	3% S., Jan., '98.	81	88
New Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4% S., Jan., '98.	16	17
Orleans Railroad	50	800,000	185,000	1% Q, June, '94.	53 1/2	54 1/2
St. Charles Street Railway	50	1,000,000	1,000,000	1% Q, Jan., '98.		
New York—Apr. 25:						
Central Crostown RR.	100	600,000	600,000	2% Q, July, '97.	150	
Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2% Q, Jan., '98.	160	165
Dry Dock, E. B'way & Battery RR.	100	1,200,000	1,200,000	1% Q, Feb., '98	175	180
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000	1% Q, Jan., '98.	134 1/2	135 1/2
Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	3% A., July, '97.	32	34
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2% Q, Oct., '97.	205	212
Gen. Park N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2% Q, Jan., '98.	177	175
8th Avenue RR.	100	1,000,000	1,000,000		810	825
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4% Q, Feb., '98	385	360
9th Avenue RR.	100	800,000	800,000		192	194
14th Avenue RR.	100	2,000,000	2,000,000		200	215
23rd Avenue RR.	100	600,000	600,000	4% Q, Feb., '98.	810	824
Twenty-third St. R. R. Co. guar.	100	2,500,000	1,862,000	2% Q, Jan., '98.	165	170
Second Avenue RR.	100	12,000,000	10,000,000	2% Q, Feb., '98.	156	160
Third Avenue RR.	100	2,500,000	2,500,000		58	61
42d St. Manhat'le & St. Nich. Av	100	2,000,000	2,000,000		175	200
*Union (Huck)berry Ry.	100	2,000,000	2,000,000			
Newark N. J.—Apr. 25:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000		44	45
Newark Passenger Ry.	100	6,000,000	6,000,000			
Rapid Transit Street Ry.	100	504,000	504,000	1 1/2% A.	180	190
Pittsburg, Pa.—Apr. 25:						
Allegheny Traction Co.	50	500,000	500,000			45
Consolidated Traction Co. com.	50	15,000,000	15,000,000	2% Jan., '98.	12 1/2	13 1/2
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3% May, '97.	45 1/2	
Central Traction Co.	50	1,500,000	1,500,000			
Citizens' Traction Co.	50	8,000,000	3,000,000	6% A.	61	61 1/2
Duquesne Traction Co.	50	8,000,000	3,000,000	6% A.		
Pittsburg Traction Co.	50	2,500,000	1,900,000	3% Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2% Q, Jan., '98.	22 1/2	24
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,839	2% Aug., '95.		
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	1% Jan., '98.		16 1/2
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5% A., June 30, '97.		
Second Avenue Traction Co. com.	50	4,000,000	14,000,000			
Suburban Rapid Transit Co.	50	800,000	200,000			

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric Ry.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$50,100 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k 75% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$35,100 of stock owned by West Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Crostown Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Railway for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 6% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 7% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bld.	Asked.
		Author'd	Issued.						Author'd	Issued.			
New Bedford Mass.—Apr. 25:							Boston, Mass.—Apr. 25:						
Union Street Railway Co.....	100	\$250,000	\$250,000	2 1/2 % Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2 % Q. Jan., '98.	247	248
Northampton, Mass.—Apr. 25:							New England Telephone Co.....						
Northampton Street Ry.....	100	800,000	225,000	4 % A., Jan., '98.	165	175	Eric Telephone & Telephone Co.....	100	...	...	1 1/2 % Q. Jan. '98.	6 1/2	63
Omaha, Neb.—Apr. 18:							New York.—Apr. 25:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2 % Q.	90	91
Paterson, N. J.—Apr. 25:							*Central & South Am. Tel. Co.....						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	8,500,000	6,500,000	1 1/2 % Q.	104	107
Providence, R. I.—Apr. 25:							Franklin Tel. Co.....						
United Traction & Electric Co.....	100	8,000,000	8,000,000	1/2 % Jan. '98.	59	62	Eric Telephone & Telephone Co.....	100	1,000,000	10,000,000	1 1/2 % Q.	188	189
Philadelphia.—Apr. 25:							*Gold & Stock Tel. Co. guar. 6 %						
Fairmount Park Trans. Co....\$20 pd.	50	2,000,000	1,770,000	2 % Dec. '97.	14 1/2	..	*International Ocean Tel. Co. guar. 6 %	100	5,000,000	4,800,000	1 1/2 % Q. Jan., '98.	413	68
Hestonville, Man. & Fairmount....	50	1,966,100	1,966,100	2 1/2 % July 15, '97.	42	45	Mexican Telephone Co.....	100	8,000,000	.....	1 1/2 % Q.	107 1/2	110
Hestonville, Man. & Fairmount 6 % pfd.	50	535,900	535,900	3 % S. Jan. 10, '98.	61	65	*New York & New Jersey Tel. Co....	100	2,000,000	.....	.....	60	70
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. guar. 4 %	100	5,000,000	8,728,000	1 1/2 % Q. Jan., '98.	140	145
Union Traction Co.....\$12 1/2 pd.	30	30,000,000	23,330,450	.....	14 1/2	14 1/2	*Postal Telegraph Cable Co.....	25	2,000,000	.....	2 % S.	71	76
Electric Traction Co.....	50	8,297,920	.....	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5 %	100	15,000,000	15,000,000	1 % Q.	87	90
City of Philadelphia Passenger Ry.....	50	500,000	.....	.....	307	..	*Commercial Union Telegraph Co....	25	950,000	559,525	2 1/2 % S.	87	90
Frankford & Southwark Pass. Ry.	50	1,000,000	1,875,000	\$1 share A.—Apr. 97	372	..	Western Union Telegraph Co.....	25	500,000	500,000	8 % S., Jan. 1 '98.	111 1/2	118 1/2
Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	89	90 1/2	Div. guar. by Postal Tel. Co.	..	97,870,000	1 1/2 % Jan., '98.	84 1/2	85	
Lehigh & South Street Ry.....	25	1,000,000	.....	.....	89	..	Miscellaneous.—Apr. 25:						
Second & Third Streets Ry.....	50	1,060,000	.....	.....	89	..	American Dist. Tel. (Phila.).....	25	400,000	.....	1 % Q. Feb. '98.	14	..
People's Traction Co.....	50	10,000,000	6,000,000	3 % A. April, '97.	265	..	Bell Tel. Co. (of Canada).....	100	8,168,000	8,168,000	2 % S.	170 1/2	178
Germantown Passenger Ry.....	50	1,500,000	1,572,800	\$5.25 share—1898.	134	135	Chesapeake & Potomac Tel. Co....	100	.....	.....	.....	47	50
Green & Coates Passenger Ry.....	50	500,000	150,000	3 % Jan., 1898.	132	..	Chicago Telephone Co.....	100	.....	.....	.....	202	..
People's Passenger Ry.....com.	25	1,500,000	1,740,000	.....	..	..	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	750,000	750,000	.....	65	75
People's Passenger Ry.....pfd.	25	750,000	277,402	.....	78	78 1/2	Empire & Bay States Telegraph Co..	..	.....	.....	1 % Q.	70	75
Philadelphia Traction Co.....	50	30,000,000	120,000,000	4 % S.—Oct. 1, '97.	78	78 1/2	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1 % Q.	112	117
Catherine & Bainbridge St.....	50	.....	400,000	6 % A.—Mar., '97.	140	..	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/4 % Q.	87 1/2	..
Continental Pass. Ry. guar.....	50	1,000,000	1,580,000	\$6 share—July, '97.	140	..	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	120	122
Empire Passenger Ry. Co.....	50	600,000	600,000	.....	180	..	ELECTRIC LIGHT AND ELECTRICAL MFG. COS.						
Philadelphia City Pass. Ry.....	50	1,000,000	1,475,000	\$7.50 share July '97	176 1/2	..	Boston, Mass.—Apr. 25:						
Philadelphia & Gray's Fy. RR.....	50	1,000,000	298,650	\$3.50 share July '97	86	..	Fort Wayne Electric Co.....	..	.....	.....	.....	..	..
Ridge Avenue Passenger Ry.....	50	750,000	142,000	\$12 share, July '97.	300	..	Ft. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	..	..
Philadelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	..	..	General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q., Aug. 1898.	80 1/2	80 1/2
17th & 19th Sts. Pass. Ry. guar.	50	.....	125,000	1 1/2 % S. July, '97.	157 1/2	..	General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	85	90
Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	135,000	\$11 sh. A., July, '97	275	..	T. H. Elec. Co. T. Secur. Series D.	..	.....	.....	.....	83	94
Union Passenger Ry. Co.....	50	1,500,000	1,900,000	\$9.50 sh. July '97	227	228	Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	20 1/2	21 1/2
West Philadelphia Pass. Ry.....	50	750,000	1,750,000	\$10 share, July '97	225	235	Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	2,996,053	1 1/4 % Q., Feb., '98.	51 1/2	53
Rochester, N. Y.—Apr. 25:							Westinghouse El. & Mfg. Co. assent.						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18	New York.—Apr. 25:						
Reading, Pa.—Apr. 25:							Edison Elec. Ill'g Co., New York..						
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	..	*Edison Elec. Ill'g Co., Brooklyn....	100	10,000,000	7,988,000	.....	118	..
City Passenger Ry.....	50	350,000	850,000	Jan., '98.	112	..	Edison Elec. Ill'g Co., Brooklyn....	100	4,000,000	8,750,000	1 1/2 % Oct., '97.	108	104
East Reading Electric Ry.....	50	1,000,000	11,000,000	Jan., '98.	64	..	Edison Ore Milling Co.....	100	.....	.....	.....	10	18
St. Louis Mo.—Apr. 25:							Edison Electric Storage Co.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..	General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q., Aug. 1898.	80 1/2	80 1/2
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec. 1888.	..	..	General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	85	90
Lindell Ry.....	100	2,500,000	2,400,000	1 1/4 % Jan., '98.	120	122	Interior Conduit & Insulation Co....	100	1,000,000	1,000,000	.....	41	..
National Railway Co.....	..	2,500,000	2,479,000	1 1/4 % Jan., '98.	..	..	United Elec. Lt. & Pow. Co.....pfd.	100	.....	.....	.....	..	..
Cass Avenue & Fair Grounds.....	..	2,500,000	2,500,000	.....	90	110	Pittsburg, Pa.—Apr. 25:						
Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct., '98.	90	110	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	..
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 % Jan., '98.	95	105	East End Electric Light Co.....	50	800,000	800,000	Q.	..	10
Missouri RR.....	50	2,400,000	2,300,000	1 1/2 % Jan., '98.	170	172 1/2	Philadelphia, Pa.—Apr. 25:						
People's RR. Co.....	50	1,000,000	300,000	50c. Dec., '89.	50	52 1/2	Edison Electric Light Co.....	100	2,000,000	.....	144 1/2	..	
Southern Electric Ry.....com.	50	500,000	500,000	.....	56	57	*Electric Storage Battery Co.....com.	100	8,500,000	.....	19	21	
Southern Electric Ry.....6 % pref.	100	1,000,000	1,000,000	1 1/2 % Jan., '98.	100	102 1/2	*Electric Storage Battery Co.....pfd.	100	8,000,000	.....	21	28	
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	56	57	*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	..	..
Union Depot RR.....	100	4,000,000	4,000,000	3 % A., July, '96.	..	..	*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	.....	6 % Oct., '97.	18 1/2	14
San Francisco, Cal.—Apr.							Northern Elec. Light & Power Co....						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	..	110	10	187,500	187,500	.....	..	..
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	Miscellaneous.—Apr. 25:						
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	53	Brush Electric Co.....	50	.....	.....	.....	..	..
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	8 1/2	Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	87 1/2	..	
Scranton, Pa.—Apr. 25:							Edison Ill'g Co. (St. Louis).....						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12	Eddy Electric Mfg. Co.....	25	.....	.....	16	..	
Scranton & Carbondale Trac. Co..	100	500,000	500,000	.....	..	18	Hartford (Conn.) Elec. Light Co....	100	850,000	.....	120	123	
Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	.....	..	..	Hartford (Conn.) Lt. & Power Co....	25	175,000	.....	6	11	
Springfield Ill.—Apr. 25:							New Haven (Conn.) Elec. Lt. Co....						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11	Narragansett (Prov. R. I.) Elec. Co..	50	1,200,000	.....	83 1/2	86	
Springfield O.—Apr. 25:							Rhode Island Elec. Protec. Co.....						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2	Royal Elec. Co. (Montreal).....	..	1,000,000	.....	2 % Q.	140	146
Springfield, Mass.—Apr. 25:							Toronto (Canada) Elec. Light Co....						
Springfield Street Ry.....	100	1,200,000	1,166,700	8 % A.	206	210	Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	1 1/2 % Q.	180	180 1/2
Toronto Canada.—Apr. 25:							Woonsocket (R. I.) Electric Co.....						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	87 1/2	87 1/2	100	.....	.....	.....	100	110	
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	244 1/2	..	*exd.						
Washington, D. C.—Apr. 25:							ALLIED INDUSTRIES.						
Belt Ry. Co.....	50	500,000	500,000	.....	..	..	Boston Mass.—Apr. 25:						
Capital Traction Co.....	100	112,000,000	12,000,000	65c. per sh. Oct. '97.	723 1/2	723 1/2	American Electric Heating Co.....	50	10,000,000	.....	..	..
Columbia Ry. Co.....	50	400,000	400,000	6 % A.	70	76	Street Ry. & Ill'g Properties.....pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1 '98	80	85
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	9	..	United Electric Securities Co.....pfd.	100	.....	.....	3 1/2 % Feb., '96.	80	85
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	116								

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

Albany, N. Y.							New Orleans La.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 18, 1898.						
NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.	NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	J. & J.	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....	Crescent City RR. Cons. mtg. 5s.	5,000,000	8,000,000	1943	J. & J.	75 1/2	77
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117 1/2	.....	New Orleans City RR. 1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	111
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	N. Orleans City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98 1/2	99 1/2
Troy City Railway Co. 1st 5s	.....	.....	.....	.....	*105	105 1/2	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	350,000	1907	F. & A.	110	.....
Interest guar. by Albany Ry. Co.							Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	99 1/2	100
Principal and interest guar. by Albany Ry. Co.							St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....
.....							*142,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
.....							*190,000 outstanding.						
Baltimore Md.							New York.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	80	87
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	Atlantic Av. (Brooklyn) 1st cons. mtg. 5s.	759,000	759,000	1909	M. & S.	108	108
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102 1/2	108	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	105	109
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114 1/2	115	B'way & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101 1/2	.....	B'way & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	107 1/2
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103 1/2	.....	B'way & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....	B'way Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	115	117
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	113	116	B'way Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	108	*107
City & Suburban Ry. 1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	113 1/2	114 1/2	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	118	116
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119 1/2	Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	83	85
The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.							Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	91	98
*151,000 in escrow to retire 1st mtg. bds.							Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108
.....							Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
.....							Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	91 1/2	94
.....							Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	103	107
.....							Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	113
.....							Central Croastown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
.....							Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	100	108
.....							D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	114	1 1/2
.....							Dry Dock, E. Bd'y & Bat'y R. scrip 5 1/2.	1,100,000	1,100,000	1914	F. & A.	100	*108
.....							Elgin Av. RR. Co. Cert. indebt. 6 1/2.	1,000,000	1,000,000	1914	F. & A.	108	.....
.....							42d St. Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	116
.....							42d St. Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	81	90
.....							Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	115	117
.....							Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	109	.....
.....							Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107 1/2	108 1/2
.....							Second Avenue Ry. Deb. 5s.	800,000	800,000	1909	J. & J.	106	.....
.....							Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
.....							South Ferry RR. Co. 1st mtg. 5s.	850,000	850,000	1919	.....	116	111
.....							Third Avenue RR. 1st mtg. 5s.	5,000,000	5,000,000	1937	J. & J.	120	123
.....							Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
.....							Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108
.....							Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111 1/2	114
.....							Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....
.....							*11,085,000 in escrow to retire gen. mtg. bonds.						
.....							*14,850,000 in escrow to retire maturing obligations.						
.....							*552,000 in escrow to retire 1st and 2d mtg. bonds.						
.....							*In treasury, \$90,000.						
.....							*Guar. by Union Ry. Co.						
Boston, Mass.							Toronto Canada.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,879,000	8,702,000	1924	J. & D.	161 1/2	105	Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	.....	.....
West End Street Ry. Deben. g. 5s.	3,300,000	8,000,000	1902	M. & N.	104	.....	Toronto St. Ry. 1st mtg. g. 4 1/2s.	4,550,000	2,200,000	1921	M. & S.	.....	.....
West End Street Ry. Deben. g. 4 1/2s.	2,000,000	2,000,000	1914	M. & S.	107	.....	*185,000 per m. single track authorized.						
*1,074,000 in escrow to retire outstanding bonds of absorbed companies.							*600,000 in escrow to retire 6s due in 1901.						
.....												
Charleston S. C.							Philadelphia.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....	Continental Pass. Ry. 1st mtg. 6s.	850,000	810,000	1909	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....	Empire Pass. Ry. 1st mtg. 7s.	800,000	200,000	1900	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.							Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	100,000	1901	.....	.....	.....
.....							People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
.....							People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....
.....							People's Pass. Ry. Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	.....	.....
.....							People's Pass. Ry. Stk. tra. cert. g. 4s.	5,698,210	.....	1948	.....	101 1/2	101 1/2
.....							Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....
.....							Philadelphia Trac. Co. Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	104	105
.....							Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1908	A. & O.	.....	.....
.....							Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....
.....							Union Traction Co. Col. tr. 4s.	29,735,000	29,735,876	1945	A. & O.	.....	.....
.....							West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....
.....							West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115 1/2	.....
.....							West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114 1/2	115
.....							*The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Chicago Ill.							Pittsburg, Pa.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Chicago City Ry. 1st mtg. 4 1/2s.	6,000,000	4,619,500	1901	J. & J.	101 1/2	102 1/2	Birmingham, Knox & Allentown. 6s.	500,000	500,000	1931	M. & S.	.....	90
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103 1/2	.....	Central Traction Co. 1st mtg. 5s.	875,000	875,000	1930	J. & J.	.....	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....	Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....
Chicago & So. Side B. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....	*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	.....
Chicago & So. Side R. T. 1st mtg. 4 1/2s.	1,500,000	750,000	1907	J. & J.	.....	.....	*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1918	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4 1/2s.	4,040,000	4,040,000	1932	J. & J.	104 1/2	.....	Fed'l St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	.....	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	.....	.....	Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1928	M. & N.	106	107 1/2
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	46	48	Pittsburg, Crafton & Mansfield. 5s.	250,000	250,000	1924	J. & J.	.....	.....
North Chicago St. RR. 1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	103 1/2	.....	Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	.....
North Chicago St. RR. Cert. indebt. 6s.	500,000	500,000	1911	J. & J.	.....	108	Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	104	105
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....	Pittsburg & West End. 1st mtg. 5s.	500,000	500,000	1922	J. & J.	.....	.....
North Chicago City Ry. consol. 4 1/2s.	2,500,000	2,500,000	1927	M. & N.	105	.....	*Pg'h., Allegh. & Manch. Gen. mtg. 5s.	1,500,000	1,400,000	1890	A. & O.	.....	110 1/2
West Chicago St. RR. 1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	103	104	Second Ave. Traction Co. 5s.	2,500,000	2,000,000	1934	J. & D.	.....	.....
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100	100 1/2	Sub. Rapid Transit Railway Co. 6s.	500,000	500,000	1918	M. & S.	.....	.....
West Chicago St. RR. Cons. mtg. 5s.	12,500,000	6,000,000	1936	.....	90 1/2	91 1/2	.....					
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....	.....				
*Redeemable at option on 60 da. notice.							.....					
*Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.							.....					
*Subject to call after Oct. 1, 1899, at 110 and interest.							.....					
*Assumed by W. Chf. RR. Co., lessee.							.....					
*Int. guar. by W. Chicago St. RR. Co.							.....					
Cincinnati, O.							Providence R. I.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Mn. New. & Cov. St. Ry. 1st Cons. mtg. g. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101	Newport Street Ry. Coupon 5s	50,000	50,000	1910	J. & D.	.....	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107 1/2	.....	United Trac. & Elec. Co. 1st mtg. g. 5s.	9,000,000	8,247,000	1938	M. & S.	104	106
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....	.....				
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	.....	108 1/2	.....					
O. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	.....	119	.....					
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1962	J. & J.	129 1/2	.....	.....				
*Assumed by the Cin. St. Ry. Co.							.....					
*1250,000 reserved to retire 1st mtg. bds.							.....					
Cleveland, O.							St. Louis.						
Date of Quotation—Apr. 25, 1898.							Date of Quotation—Apr. 25, 1898.						
Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1906	M. & S.	106	107	Baden & St. Louis RR. 1st mtg. 6s.	250,000	250,000	1918	J. & J.	100	102
Mn. New't & Cov. St. Ry. Cons. mtg. 6s.	8,000,000	2,500,000	1922	J. & J.	99	101	Cass Ave. & Fair Gds. Ry. 1st mtg. 6s.	2,000,000	1,901,000	1912	J. & J.	102 1/2	103 1/2
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000											

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—Apr. 25, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co.....1st mtg. 5s.	1,000,000	700,000	1916	M. & S.	105	107
Mount City RR. Co.....1st mtg. 6s.	400,000	300,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	300,000	300,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	111½	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Apr., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	127	129½
Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
Omni-bus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR.....1st mtg. 6s.	850,000	350,000	1912	J. & J.	108½	.....
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Apr. 25, 1898.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....Cons. mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home Ry. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. 1st cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Apr. 25, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	103
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
†Citizens' St. R. (Ind. polis.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	79	80
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	108	109
†Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
†Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	100½	101
†Crosst'n St. Ry. (Columb., O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	100	104
†No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
†No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
†Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
†Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	101	102
†St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,238,000	1937	.....	89	92
†St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$47,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						
*With int' rest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Apr. 25, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	100½	.....
Pittsburg, Pa.						
Date of Quotation—Apr. 25, 1898						
Allegheny County Light Co. ....6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light.....4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(Apr. 25, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,186,000	1933	.....	114½	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia)...	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'y.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Apr. 25, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telephone Co. ....7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. ....5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Apr. 25, 1898.						
American Electric Heating.....5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. ....7s.	.....	.....	.....	.....	.....	25
*Barney & Smith Car Co. ....7s.	.....	.....	1942	J. & J.	95	100
Corbournum Mfg. Co. ....5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. ....5s.	75,800	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 12½c.; casting, 11½c.

The directors of the Chicago Edison Company on the 19th inst. declared the regular quarterly dividend of 2 per cent.

The court has authorized the receivers of the Brighton Beach Railroad Company, Brooklyn, N. Y., to issue \$50,000 of receivers' certificates.

The Colonial Trust Company has filed at Richmond, Staten Island, a mortgage of \$1,000,000 against the New York & Staten Island Electric Company.

Emerson McMillin has resigned the presidency of the Columbus (O.) Street Railway. Robert E. Sheldon has been elected by the directors to fill the vacancy.

The West End Electric Company of Philadelphia has declared a semi-annual dividend of 5 per cent. on its capital stock, payable May 2. Books reopen May 2.

The gross earnings of the Edison Electric Illuminating Company of New York for March were \$263,975, an increase of \$56,105, and net \$113,223, an increase of \$18,805.

No agreement has yet been reached between the surface railroads and the Brooklyn Bridge Commissioner in regard to the proposition to increase the trolley tolls on the bridge.

The Woburn (Mass.) Light, Heat & Power Company has been given the privilege of issuing \$110,000 stock and \$175,000 bonds. Of the latter \$85,000 will be used to retire outstanding bonds.

The Market Street Railway Company of San Francisco is paying a quarterly dividend of 60 cents per share for the first three months of this year. The aggregate sum is about \$112,800.

There has been no decision made yet by the Attorney General of New York in the application made to him by the minority stockholders of the Kings County Traction Company of Brooklyn for a receiver.

The New Harrison Telephone Company has been incorporated at Columbus, O., with a capital stock of \$100,000. The incorporators are George W. Hull, H. T. Hull, L. C. Cunningham, D. W. Morris and John P. Manton.

The reported deal between the Edison Electric Illuminating Company of Brooklyn and the Municipal Company of that city has not yet been closed, but the negotiations that have been going on for some time are likely to have an early termination.

The Milwaukee, Racine & Kenosha Electric Railway Company has called in all of its old bonds and issued another series of 375 bonds of \$1,000 each to the Savings & Trust Company of Cleveland, O., bearing interest at 6 per cent. and running thirty years.

"The statement is made," says the Boston "Commercial Bulletin," "that no plan for a settlement with General Electric preferred stockholders and correction of capital impairment will be submitted to stockholders at the annual meeting of the company, May 10, as was proposed."

A Chicago special says there is a rumor in that city that the General Electric Railway Company has an unimpeded right to begin construction and that C. T. Yerkes will be an important factor in the organization. It is said that Mr. Yerkes has already an interest in the company and that he will arrange to finance the company to the extent of furnishing the funds with which to complete construction.

J. B. Speed, president of the Louisville Railway Company, has presented his resignation to the directors of the road. The resignation will take effect May 1. The Louisville "Courier Journal" says Mr. Speed will remain in the directory and on the executive committee, and expects to devote much time to the affairs of the road, though not so much as formerly. He is a large stockholder and expects to retain his present interests. Mr. Speed will be succeeded as president by General Manager Minary, who will combine his old duties with the presidency for the present.

Schedules of the American Range Finder Company, New York, show liabilities of \$58,129; nominal and actual assets, \$2,500. There are only three creditors: Samuel D. Davis & Co., \$50,167, for cash advanced and on a note; Western Electric Company, \$5,396, and D. W. McWilliams, \$2,566. The assets consist of the right, title and interest of the company on various patents subject to a contract with Bradley A. Fiske. There are eighteen United States patents and thirty-one foreign patents for range finders, position finders, electrical signaling system, telescopic sights for guns, etc.

A Chicago paper says: "It is announced that in all probability the Illinois Central will not attempt to change its motive power for suburban trains from steam to electricity this year. It will await the result of the experiment of the South Side Elevated with the Sprague motor. It is said also that the Westinghouse Electric Company is anxious to build a few locomotives for the use of the Illinois Central, though it is hardly expected that an electric locomotive will have the advantages of the Sprague system."

The directors of the Holyoke (Mass.) Street Railway Company have authorized the issuance of the \$100,000 worth of new stock recently recommended by the stockholders and which was sanctioned by the State authorities. The matter of increasing the machinery at the power house with a view to bettering the efficiency of the service the directors left with the officers of the company.

The board of freeholders of Union County, N. J., will probably find it more difficult to sell the franchise for the trolley road between Plainfield and Elizabeth than was anticipated. John Kean's offer of \$100,000 is the only one yet made although the sale takes place May 5. It is believed that at least \$250,000 will be required to widen the county road between the two places and this must be done according to the plan for the trolley line.

The Albany (N. Y.) Railway Company in its report to the Railroad Commissioners for the quarter ending March 31 shows an increase of \$20,207 in the gross earnings as compared with the same quarter of 1897 and an increase in the net income of \$11,244. The figures for the 1898 quarter are: Gross earnings, \$145,584; operating expenses, \$96,393; net earnings, \$49,190; other income, \$734; gross income, \$49,925; fixed charges, \$24,963; net income, \$24,961.

The annual meeting of the Citizens' Street Railway Company of Indianapolis will be held May 10. A number of stockholders have issued a circular asking for proxies to be sent to E. D. Toland for the election of the following gentlemen as directors for the ensuing year: W. W. Kurtz, W. Jay Turner, R. H. Rushton, Dr. Joseph S. Neff, William C. Houston, B. M. Gaskill and J. Levering Jones. The circular says: "At the present time there is one vacancy in the board of directors and the office of president is vacant. Mr. W. W. Kurtz, the vice-president, has acted efficiently as president in the interim. The property is a valuable one if completely extricated from the unusual legal and local complications which surround it. These complications, if the interests of stockholders are to be adequately protected, should be earnestly and energetically dealt with by a full board, representing substantially and equitably all stock interests, headed by a president devoting his entire time to the development of the property and the solution of the problems surrounding it. The board above proposed will be able to make strong alliances in Indiana. This plan this board, if elected, can pursue as the first necessary step towards an adjustment of the difficulties. All the gentlemen recommended represent large holdings of stock of the company and leave no substantial interest unrepresented."

ELECTRICITY.

Vol. XIV.

NEW YORK, MAY 4, 1898.

No. 17.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE, -	2.00
FOREIGN COUNTRIES, -	4.50
SINGLE COPIES, -	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements, -	iv
Classified List of Advertisements, -	viii
Editorial Notes, - - - - -	257-258
General Electric.	
Opening of the Electrical Exhibition.	
Electro-Magnets and Sunken Vessels.	
Effect of War on the Electrical Industry.	
Under the Searchlight, - - - - -	258
The Opening of the Electrical Exhibition, -	259
General Electric's Sixth Annual Report, -	261
The President's Report.	
First, Second and Third Vice-Presidents' Reports.	
Riveting by Electricity. By F. Von Kodelitsch, -	265
American Institute of Electrical Engineers, -	265
Important Deal Closed, - - - - -	265
Legal Notes, - - - - -	265
Bids Wanted for Telegraph Material, - - -	265
Annual Meeting of Joseph Dixon Crucible Co., -	265
Canadian Notes, - - - - -	266
The News, - - - - -	266
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous.	
Commercial Paragraphs, - - - - -	267
Incorporations, - - - - -	268
Electrical Patent Record, - - - - -	268
Telephone and Telegraph, - - - - -	268
Electrical Securities—Stocks, Bonds, Etc., -	269
Notes for Investors, - - - - -	272

EDITORIAL NOTES.

The Sixth Annual Report of the General Electric Company is out and will be found in full elsewhere in this issue. As usual, it puts a sorry figure as a sample of the prosperity and business methods in the electric business. We shall analyze this carefully at the proper time, as has always been our custom, but in the meantime a few points regarding it may not be out of place.

Patents are still carried at \$8,000,000, but hints are given that this account needs revaluation. Gross earnings for the fiscal year ending January 31, 1898, are given as \$12,524,938.07, which is \$295,457.80 less than those of the year previous.

We have frequently stated that no manufacturing concern in the electric business should have a capital in excess of the amount of its gross yearly earnings. In other words, it should turn its capital over at least once a year. Therefore the capital liabilities of the General Electric Company should not exceed (allowing liberally) \$13,000,000. According to the Sixth Annual Report they are:

Common stock.....	\$30,460,000
Preferred stock.....	4,252,000
Debentures.....	6,000,000
	\$40,712,000
Add accrued interest on preferred stock.	1,339,380
Total.....	\$42,051,380

It will be seen that the debentures and preferred stock, with accrued interest, are obligations which must be paid in full and amount to \$11,591,380. Now if this amount is deducted from what we believe to be a proper capitalization of the company—\$13,000,000—it would leave only \$1,408,620 for the common stockholders, and as there are 304,600 shares of this stock issued the value of General Electric common stock would be about \$4.63 per share on this basis of figuring.

* * *

Opening of the Electrical Exhibition.

The Electrical Exhibition, which is being held under the auspices of the New York Electrical Society, was formally opened Monday evening in the presence of a large throng of people. Madison Square Garden was probably never more attractive, brilliantly lighted as it was by thousands of incandescent and arc lights. The exhibits as a whole were tastefully and attractively arranged, incandescent lights playing an important part in the decorative arrangement and producing an extremely harmonious and pleasing effect. Although it is too

early to record anything of the accomplishments achieved through the untiring energy of the management, and especially through the unceasing efforts of Mr. Marous Nathan, the general manager, it is safe to predict that this Electrical Exhibition will far surpass in point of interest any previous efforts in this line. Not only has the management succeeded in securing exhibits and attractive features of interest to the savant and theoretical experimentalist, but the layman and practical worker have by no means been lost sight of, many popular features of various kinds having been provided.

From the auspicious opening it can be readily foreseen that the Electrical Exhibition is destined to be an overwhelming success. The management has thoughtfully provided a large number of interesting events and competitions which will take place on different evenings during the Exhibition period, and should go far toward making the Exhibition most enjoyable. For instance, the telegraphic tournament, which is looked forward to with much interest, and in which a large number of operators are expected to compete, will take place May 13 and 14. Later on it is the intention of the officials of the Exhibition to offer suitable prizes for essays on the show. Elsewhere in this issue will be found in detail an account of the opening night, including a description of the most prominent exhibits and principal features of interest. As the Exhibition progresses an account of the various events will be found in our columns.

In closing these remarks it is but just to the managers to say that they have more than fulfilled their promises, and deserve to be warmly commended for the fine showing they have made in every department of the Exhibition.

* * *

Electro-Magnets and Sunken Vessels.

The lifting power of electro-magnets is well known, as such devices are extensively used in various iron works throughout the country for moving heavy plates or pieces of metal from one point to another. Lately, in England, a scheme has been suggested for lifting the steel battleship Victoria, which lies in 450 feet of water off the harbor of Tripoli. It is proposed to place a fleet of wrecking pontoons over the spot where the Victoria lies, and from the sides of these let down large electro-magnets attached to chains. When these magnets come in proximity to the sides of the steel ship, they are supposed to take hold. The weight of the wreck is said to be 7,000 tons, consequently a large number of magnets would be required. It is thought that 70 would be sufficient, each having a pulling force of 100 tons. This would mean that each magnet would require to have a magnetized face of seven square feet. A delicate electrical dial on the pon-

toon would record the depth to which the magnet had sunk, and the power with which it had attached itself to the battleship would be shown in the same way. If the force of the magnetic influence is not great enough to stand the strain that will be put upon it when the work of raising the ship begins, it is proposed to loosen the magnet's hold and move it until a firm grip is obtained. When all the electromagnets have taken hold the work of raising the wreck will begin. On the pontoons are to be powerful hydraulic rams and motors which will do the lifting. Each lifting cable will be attached to the pontoon by means of a sheave on the head of a hydraulic lifting ram having a stroke of twelve feet, which would give an effective lift of twenty-four feet. It is proposed to connect all the hydraulic cylinders together, and a balancing accumulator would prevent any rope getting more than a normal strain of 100 tons. The wreck would gradually be lifted by stages of twenty feet until within a short distance of the surface, when it would be towed into shallow water.

A practical test of this method of raising a sunken vessel is said to have been tried recently in England on an experimental scale. In the demonstration the depth of water, the lifting capacity of the magnets and all other things were relatively the same as those of the actual undertaking. Although such a trial might give satisfactory results on a small scale, it is very questionable whether any such scheme could be made to raise the Victoria. In the first place a magnet to take a good hold should rest on an even and level surface, a slight roughness materially decreasing the pulling power, and it is only natural to suppose that a ship that has lain for several years under water would by no means offer a clean surface for a magnet to grip.

Furthermore, electromagnets powerful enough to lift 100 tons would be exceedingly bulky and unwieldy, and it is extremely doubtful if they could be properly managed from pontoons subject to the action of the waves. The attempt if ever made will undoubtedly be watched with interest, but it will be surprising if it succeeds.

* * *

Effect of War on the Electrical Industry.

Now that hostilities have actually begun between Spain and this country, the question that is anxiously asked by members of the trade is, what effect the war will have on the electrical industry? This happens to be one of those questions easily asked but well nigh impossible to answer with any degree of certainty, principally owing to the fact that as far as the electrical line is concerned we have had no precedent to judge by. At the time of the Civil War electricity was little known outside of the laboratory, and furthermore, in view of the fact that conditions then were very different from what they are at the present time, it would be utterly useless to point to the effect the war of '61-'65 had on any existing trade at that time and say that the electrical industry of to-day would be affected in a similar manner. A civil strife is always far more disastrous to the business interests of a nation than war with a foreign power.

The uncertainty of the past few months has unquestionably caused a number of contracts for electrical apparatus to be withheld that would otherwise have been given out, but on the other hand, and to offset this, the Government has been a large purchaser of electrical supplies. The electrical industry as a whole during the past few years can scarcely have been called prosperous, and if the present unsettled condition of the country should have a tendency to keep in abeyance large enterprises for any great length of time, it would be a serious matter to the majority of electrical manufacturers. It scarcely seems likely, however, that the struggle in which this country is at present engaged will be a protracted one. The manufacturers of power for lighting and street rail-

way purposes should be affected but little, if at all, as it should be borne in mind that owing to the war thousands of persons who otherwise would have gone to Europe will remain at home, and the money that would have been spent abroad, amounting, it is claimed, to one hundred millions a year, will necessarily be spent in this country. Of the above amount it is only reasonable to suppose that at least a small portion will be spent for luxuries in the electrical line, such as illumination, trolley riding, etc.

During the past fiscal year the United States exported electrical apparatus to the amount of \$3,054,453, and there would seem to be no reason why the above amount should not be exceeded during the present fiscal year, as there undoubtedly is a growing demand for our electrical machinery abroad. As all goods exported would presumably be in ships covered by neutral flags, they would likely go through safely, in spite of the fact that these vessels would be subject to the right of search. This would simply entail an extra cost of insurance. Secretary Gage is probably very nearly correct when he states: "I think after the first flush of excitement is over all our domestic affairs will go on about as they have gone on for the last several months."

Under the Searchlight.

Notes and Comments on Various Topics.

THE Boston, Mass., *Advertiser*, a paper usually very friendly to the General Electric Company, sizes up the Sixth Annual Report of that company as follows:

The full report of the General Electric, of which a brief summary was given yesterday, shows a disappointing year's business though in partial excuse of this the annual report says that heavy orders given in 1897 were unfilled at the time of the making up of the yearly statement.

The showing for the year is an infinitesimal profit considering the unwieldy bulk of the inflated capitalization of the company. In dollars and cents it amounts to the equivalent of 7 per cent. on the preferred stock and about 3 per cent. on the thirty odd million of common.

The process of buying back the debenture 5s continues, \$2,000,000 having been bought and cancelled during the period of the report while \$240,000 more have been acquired since the report was made up. These bonds were not, of course, bought from money made on the business for the year, but has been simply the converting of assets into a reduction of the debt of the company. Probably the choicest of the stocks and bonds of other companies held in the treasury were disposed of to cancel these bonds as the price received was nearly the par value.

The matter of paying off the debentures seems to be merely acquisition of the marketable quality of the securities held as treasury assets, and it is probable that with those sold to the Street Railway & Illuminating Trust and those disposed of privately about all the best have been marketed. The total debentures bought in now amount to \$4,290,000 of the total \$10,000,000 issue, and if all are to be eventually cancelled, it will likely have to be from earnings of the company in a greater degree than in the past.

As there is now 3 1/4 per cent. cumulative dividends still due on the preferred stock it can be seen that when the knife goes into the company under any reduction of capitalization it will have to go deep to be effectual.

The report treats the loss of the Van Depoele trolley patents in a rather gingerly manner, and hopes, naturally, that a court of higher resort will reverse the decision against the company.

The point is made:

"In view of the fact that nearly all of the railway companies in the country that would be likely to use the overhead trolley system are now electrically equipped, and that the third rail and underground conduit methods are being rapidly adopted for the important new enterprises, an adverse decision in this case will have but slight effect upon the business of your company."

This is all very well, but no marking off of patent valuation is made on the balance sheet, the \$3,000,000 standing as heretofore. This will be heavily cut in any reorganization of the company, of course. Mr. Collin intimates this when he says "the question of a revaluation of patents is one to which consideration should be given at the proper time." What expense is now entailed in acquiring new patents and in patent litigation is now written off to profit and loss. This is the small concession made thus far to the \$3,000,000 patent valuation—that no additions are being made. As has been the case for several years, General Electric common stock has no intrinsic value to speak of at present,

and at the rate of business last year will not have for some time to come whether reorganized or not.

* * *

PRESIDENT KILGOUR of the Cincinnati Street Railway Company has received from a Chicago damsel a letter that he probably treasures more than any of the tender missives of his youthful days, for it has relieved him of a perplexity that he despaired of removing after having tried all the arts and arguments of his astute managerial intellect. The letter explains itself:

"Chicago, Ill.

"To President Kilgour.

"Dear Sir: Having just read in the *Cincinnati Enquirer* that so many ladies had waited on you, and found fault with the car conductors for eating onions, I thought I would give you a little recipe of my own that I have never known to fail, as I am very fond of the fruit myself at this season when the markets are full of young green fresh vegetables, and I like to see other people enjoy them also. I find that a sprig of fresh green parsley, with salt, eaten after onions, removes all bad odor of the breath. Yours,

A CHICAGO GIRL.

"P. S.—Give your conductors this recipe, and let them enjoy the privileges of free American citizens, and eat all the onions they want and oblige

A. O. G."

* * *

COMMODORE DEWEY must have been within hearing of Farragut when he exclaimed "Damn the torpedoes—go ahead!" and he bettered the instruction at Manila.

* * *

HERE is a stave about electricity which tells its own story:

"In olden times we took a car
Drawn by a horse, if going far,
And felt that we were blest;
Now the conductor takes the fare
And sticks a broomstick in the air
And lightning does the rest.

"In other days, along the street,
A glimmering lantern led the feet
When on a midnight stroll;
But now we catch, when night is nigh,
A piece of lightning from the sky
And stick it on a pole.

"Time was when one must hold his ear
Close to a whispering voice to hear,
Like deaf men—nigh and nigher;
But now from town to town he talks
And puts his nose into a box
And whispers through a wire."

* * *

A LOCAL daily says: "Mr. Nikola Tesla announces to humanity that he thinks he knows how to convey an electric spark to the interior of a distant Spanish magazine and explode such magazine neatly. Mr. Tesla's duty is clear. He should retire now from the public prints and all his favorite haunts and work like a beaver. He should reappear prepared to prove his idea with a genuine test, or frankly to announce his failure. A man with an idea as important as Tesla's has no right to sit about talking of it. If a hen came along and said, 'I think I contain a diamond egg,' we should say to her, 'Get on your nest and don't come off until the egg is laid.' We give similar advice to Mr. Tesla."

* * *

ANOTHER gambling scheme has been set afloat in Boston. A bill permitting the placing of bombardment insurance has been rushed through the Legislature.

* * *

THE Atlanta *Constitution* gives publicity to the following:

A Georgia man who is interested in a small vessel lying in Northern waters telegraphed home:

"The Revill is fast in the ice."

The Revill was the name of the vessel, but the telegram, as delivered, read:

"The Devil is fast in the ice."

An old negro, an employee, was present when the message came, and asked:

"What does Mars Tom say in dat telegram?"

"He says," replied the man to whom it was delivered, "that the devil is fast in the ice."

"Halleluyer!" shouted the negro. "Halleluyer! I hope ter God dey'll keep him dar!"

Opening of the Electrical Exhibition.

President McKinley Starts the Machinery by Touching a Golden Key in Washington.

CHAUNCEY DEPEW ELECTRIFIES THE CROWD.

Fine Display of Electrical Machinery and Kindred Apparatus—Interesting Historical Exhibits.

No less than six thousand persons attended Madison Square Garden on the evening of May 2 to witness the formal opening of the Electrical Exhibition which is being held under the auspices of the New York Electrical Society.

President McKinley, by touching a golden key in the White House, gave the signal for the starting of the machinery. A congratulatory telegraphic message was also received from the President, as follows:

"It gives me great pleasure to open the Electrical Exhibition in Greater New York, and to participate in this wonderful demonstration of the latest method of recording and publishing by means of electricity. I congratulate you upon the achievements of American genius. I am glad to know that the resources of the wonderful electrical arts have already been so far advanced in the United States that American electrical goods are welcome the world over."

Vice-President Hobart addressed the audience by telephone in the following strain:

"I respond with pleasure to the invitation of the New York Electrical Society to assist in opening the Electrical Exhibition held under its auspices at Madison Square Garden, and beg to express my wishes for its success as a means of promoting further advances in the great electrical and engineering arts with which our national fame is already so proudly associated. I congratulate the citizens of the Greater New York that they have this opportunity of studying all that is latest and best in the science to which Franklin, even in the midst of patriotic duties and cares, gave his transcendent genius."

The Vice-President's message was received on a phonograph cylinder, which kept repeating it over and over again the whole evening.

Chauncey M. Depew was the central figure of the evening. With his usual versatility he kept the vast throng interested in electricity and enthusiastic on the subject of the war and our recent victory. At the close of his address he touched a button which caused a gun to discharge by means of Hertzian waves, firing into the air and directly over the heads of the assembled multitude a long projectile which ultimately exploded scattering a large number of small American flags in all directions. The band meanwhile played the "Star-Spangled Banner," and there was great enthusiasm.

The remarkable success attending the opening of the Exhibition and the excellent showing made, in spite of the fact that many of the exhibits were still unplaced and a number of interesting features were not on hand owing to delay in transportation, the railroads being busy rushing troops to their rendezvous, are due to the untiring energy of the following gentlemen, the officers of the Exhibition: C. O. Baker, Jr., President; F. W. Roebing, Vice-President; Geo. F. Porter, Secretary and Treasurer. The Executive Committee is made up of the following well-known men: H. H. Harrison, L. F. Requa, C. O. Baker, Jr., ex officio; Prof. F. B. Crocker, consulting engineer; Marcus Nathan, general manager; Thomas A. Edison, Jr., Committee on Decorative Effects; Max Osterberg, Construction Engineer.

FEATURES OF INTEREST.

Probably one of the most interesting features is the vacuum tube light invented by D. Macfarlane Moore. A number of these tubes are located in a specially designed chapel and are so arranged as to conform to the groins of the arches. The light diffused is unquestionably wonderfully soft and pleasant. Mr. Moore's system of vacuum tube lighting has been perfected since the Electrical Exposition of 1896.

The tubes used in the illuminating of the chapel are the first designed for such work, and it is safe to predict that the chapel will be the center of attraction throughout the month, especially as it is equipped with an electric church organ and the management intend to have it played upon by some well known artist.

Perhaps in the way of the spectacular the eight historical wax tableaux, illustrating the successive developments in electrical science, should take first place. These tableaux are located in eight niches in what is known as the Concert Hall, and around them it is proposed to group the old electrical books and pictures that relate to the subjects touched on. As will readily be seen, this latter exhibit should prove of value from an educational standpoint.

Another exceedingly interesting feature of the Exhibition is the model of Mr. Edison's ore milling machinery. This and a large number of other apparatus are to be shown in operation just as soon as possible. A feature of the Exhibition in which popular interest centers at the present time is the tank located in the middle of the Garden, and in which on the opening night a miniature ship was blown up by means of an electrically-operated submarine mine. When Dr. Depew touched the button a crash was heard and the model disappeared in a column of spray which shot high up in the air.

The management has provided a large number of other interesting and attractive features of which we shall make mention and describe in a subsequent issue.

COMPANY EXHIBITS.

The exhibit of Thomas A. Edison, Jr., which is located on the main floor, near the Madison avenue entrance, consists in a handsomely decorated booth with innumerable lamps of Mr. Edison's manufacture arranged in circles on the wall at the rear. A number of switches enable any circle to be either lighted or extinguished. When all these circles of varied colored lamps are lit the effect is very pleasing.

The Ward Leonard Electric Company exhibited various styles of their automatic magnetic circuit breakers in sizes from a few amperes up to 2,000 amperes. They also have on exhibition a variety of automatic rheostats, one especially being a very neat style of rheostat for small ventilating fans. An interesting feature of their exhibit is a new type of underload and overload rheostat which is known as the SK type, and which has many novel and valuable features. The compact size and simplicity of this automatic, and its reliability in action, will commend it to the electrical trade. The Ward Leonard

Company also exhibited various forms of the well-known Carpenter enamel field rheostats, and a large variety of the porcelain lined outlet boxes and switch boxes, etc., which have become standard for recent high grade wiring installations in New York City.

The Faries Manufacturing Company's exhibit is located on the 27th street side of the Garden, on the promenade just above the main floor. This company is exhibiting their well-known Universal electric lamp-holders, aluminum and steel lamp shades and a line of fire and water tube boiler cleaners.

The Weston Electrical Instrument Company's exhibit is on the main floor on the 26th street side of the Garden. This company is displaying a complete line of measuring instruments and appliances. Prominent among them are their laboratory standard voltmeters and ammeters, alternating and direct current voltmeters, wattmeters, ground detectors, commercial iron-cased station voltmeters and ammeters, galvanometers, etc. A feature of their display is a well-arranged assortment of parts of instruments which affords an excellent opportunity of studying the construction of the numerous types of instruments manufactured by the company. They also afford an object lesson illustrating the care and exactness with which every detail, however minute, has been worked out.

Mr. H. B. Coho is exhibiting, as agent for the Warren Electric Manufacturing Company of Sandusky, an improved Warren alternator of 75 kw. capacity, and intends to operate same with an Eddy direct current motor. This alternator is connected for double voltage, half the capacity of the machine to deliver current without the use of transformers direct to 110-volt lamps, the other half connected up for a potential of 1,100 volts on current to be reduced by transformers. The machine when in operation will be excited by a lately improved Warren direct current dynamo, which is a bi-polar machine, over-magnet type, and is of an entirely new design, combining many elements of extreme simplicity with exceptionally high efficiency. The alternator will be operated at a speed of 800 revolutions per minute, contains no brushes, collector rings or revolving armature, the current being taken from a stationary element of the machine.

The exhibit of Henry R. Worthington, located on the main floor at the Madison avenue entrance, consists of a fine display of pumps of various sizes and types. Worthington electric pumps are also made use of in the basement for feeding water into Babcock & Wilcox boilers, and another Worthington electric pump is employed to keep water in the basin in which the submarine mine experiments are made.

The Fort Wayne Electric Corporation are exhibiting an unusually large amount of fine machinery. Among other things there is a "Wood" arc dynamo of 80 2,000 candle-power arc lamps capacity, fitted with self-oiling and aligning bearings, improved armature and new reversible regulator, same directly connected to 4-pole direct current motor. The current generated by the dynamo is utilized to operate a bank of arc lamps of the latest styles manufactured by the Fort Wayne Corporation. Another machine on exhibition is a 37½ kilowatt compound wound low-frequency alternator (60 cycles) operated by direct current motor. This alternator operates a 5-horse-power self-starting single phase alternating current synchronous motor, arc lamps and recording meters. Besides the apparatus on the main floor the Fort Wayne Corporation has a dynamo in operation in the basement.

The exhibit of the National Phonograph Company attracted considerable attention on the opening night. A throng was constantly congregating before this handsomely decorated booth to hear some popular melody or speech being reproduced.

The department of railway exhibits is particularly strong at this Exhibition, one reason being on account of the unlimited floor space available. A full

size electric car, with all the latest improvements in the way of motors, electric heaters, etc., is on exhibition near the Fourth avenue side of the Garden.

The Sprague Electric Company, whose exhibition booth extends along the Fourth avenue side of the Garden, has an exceedingly nicely gotten up exhibit, consisting of electric fans and various other apparatus for which this company is well known.

The Electric Storage Battery Company of Philadelphia and New York is the neighbor of the Sprague Company and shares with them the honor of occupying all the space at the east end of the main floor.

The Safety Insulated Wire & Cable Company has considerable space in the way of an exhibit located along the north side of the promenade. Samples of their cables and wires were to be seen tastefully arranged. The company was also giving away attractive little souvenirs of cardboard showing the various coverings of an armored cable.

The Bossert Electric Construction Company of Utica, N. Y., are exhibiting on the 26th street side of the main floor a collection of their high grade steel outlet, out-out and switch boxes.

The beautiful exhibit of the Marconi wireless telegraphy apparatus which is in the hands of Mr. W. J. Clarke, located on the 27th street side of the promenade, attracted considerable attention.

As many of the most interesting features of the Exhibition were not in operation on Monday evening, as previously stated, a description of these will appear in a later issue, as well as a further description of various other leading companies' exhibits.

SOCIETY MEETINGS.

The New York Electrical Society propose to hold a meeting once a week, in a room specially set apart for them in the Garden, at which a technical paper will be read. Elaborate arrangements have also been made for the meetings of about fifty associations of the National Association of Stationary Engineers.

These associations, it is expected, will come from New York, New Jersey, Pennsylvania, Massachusetts, Rhode Island and Connecticut. Several rooms suit-

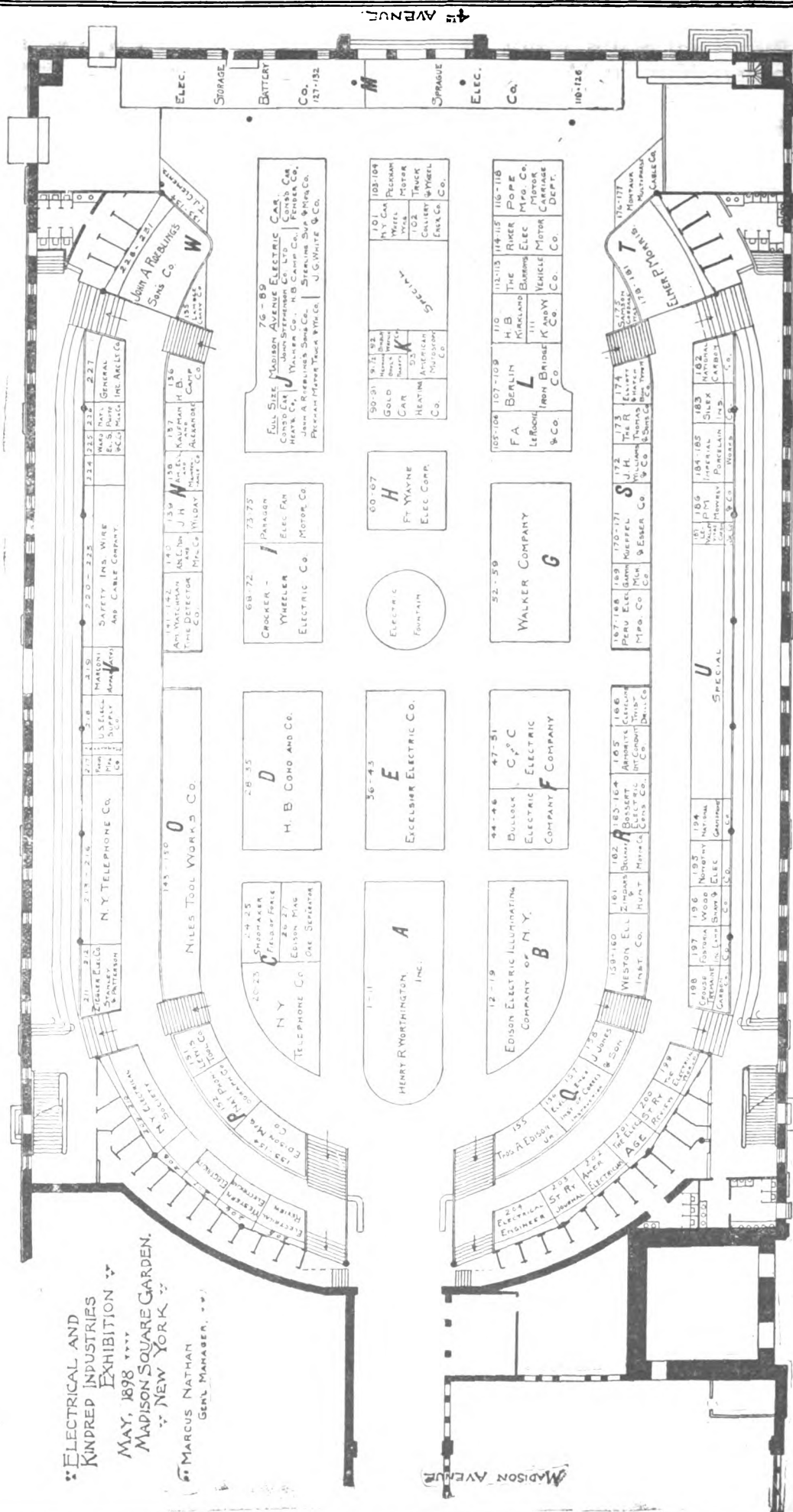
It is expected that there will be an attendance of at least 5,000 practical engineers (two lodges every evening). The Exhibition management has thought-

fully arranged a registry system with bulletin boards in different sections of the building so that the exhibitors may know just what associations of engineers are present and what plants they are connected with.

The Brooklyn Polytechnic Institute and Dr. Samuel Sheldon, its Professor of Physics and Electrical Engineering, have kindly loaned the Electrical Exhibition several interesting units and standards upon which precision in electrical measurements is based. Even the electric public, while it bears a great deal of such standards rarely sees them, and this exhibit is therefore of technical and popular interest. The exhibit includes especially some standards from the German Imperial Physico-Technical Institute (Reichsanstalt), whose celebrated work has been done under the guidance of such men as Helmholtz and Kohlrausch, and it is probable that these standards have never before been exhibited in this country.

Dr. Sheldon will show the Reichsanstalt form of the standard Clark cell, the Reichsanstalt pattern of photometer, with Hefner amyloacetate lamp and Lummer-Brodhun contrast screen, standard .01 ohm for carrying heavy currents, large standard compensation set for the precise comparison of voltages .01 to 1,200 volts and currents of any magnitude, standard Wheatstone bridge, Thomson's double bridge for conductivity measurements, standard Carhart-Clark cell, etc. The exhibition of such apparatus and the explanation given as to its use will do much to bring electrical measurements within the comprehension of the

public, and to demonstrate the wonderful refinement of accuracy that modern electricians aim at in their apparatus. It should be especially appreciated by electrical students.



able for meetings have been provided, and various lodges will hold their meetings there on their regular meeting nights as the guests of the Exhibition Company.

General Electric's Sixth Annual Report.

EARNINGS FOR THE YEAR LESS THAN THOSE OF LAST YEAR.

A "DEAD SEA APPLE" FOR STOCKHOLDERS.

The Press Bureau's Rosy Statements Turn Out to be Baseless Fabrications.

The following is the full text of the General Electric Company's Sixth Annual Report—for the year ending January 31, 1898:

PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 25, 1898.

To the Stockholders of the General Electric Company:

The past year witnessed a revival in business which increased rapidly in activity and volume during its latter months.

In the last annual report attention was called to the fact that your company began the year with less orders on hand than previous seasons. As a result of this, the actual output of your works has been slightly smaller than in previous years, although the orders received during the period have shown a marked increase. This increase will be reflected in the shipments of the ensuing year.

A careful scrutiny of the assets of your company, other than its patents, leads to the belief that previous values were conservatively fixed, and no changes of any significance have been necessary.

The patent account of the company has been kept at substantially the same amount on its books since the organization of the company. The question of a revaluation of patents is one to which consideration should be given at the proper time.

BUSINESS OF THE YEAR.

Gross earnings.....	\$12,524,938.07	
Less expenses.....	10,727,692.02	\$1,797,246.05
Interest and discount, and interest and dividends received on securities owned.....	\$389,789.16	
Less:		
Interest on debentures.....*	833,838.85	56,455.81
		\$1,838,701.86
Deduct amounts written off:		
Sundry losses and allowances for possible losses.....	\$79,220.42	
Patents and patent expenses...	333,334.68	
Inventories and consignments..	89,665.70	
Reserve for extensions to factory plants.....	250,000.00	
	\$752,220.80	
Less:		
Profit on securities sold and debentures cancelled.....	130,371.81	621,849.49
Reduction of the deficit of previous years...	\$1,231,852.37	

*On \$3,000,000 for four months and on \$6,000,000 for eight months.

In addition to the purchase of \$2,000,000 of debentures referred to in previous annual reports, your company has purchased during the year just ended \$2,000,000, and the entire \$4,000,000 have been destroyed. Since the books were closed \$290,000 additional have been acquired, and are now held in the treasury of the company.

An increase is shown in the amount received from interest and dividends from securities owned. It is expected that the income from this source will still further increase from year to year, unless considerable sales of such securities should be made by the company.

The growth of your business has made it necessary to make further expenditures for additions and

changes at your factories and in acquiring much additional machinery.

Plans have been prepared and contracts partially closed for a new foundry and a large and important machine shop, the largest buildings yet erected by your company.

In anticipation of the investment in the construction and equipment of these new shops, which it is estimated will cost about \$500,000, the sum of \$250,000 has been deducted from the profits of the past year and carried to factory reserve account.

It has been the practice of the company to write off the amounts expended for additional factory facilities. It is thought that these allowances are not more than are required to properly provide for depreciation in all your factory plants taken as a whole.

At the annual meeting of the stockholders, held four years ago, the question of reducing the company's share capital in the manner prescribed by law was referred to the directors. Since that time the matter has had the earnest attention of your board, and it is their hope that a plan will be submitted for your consideration at an early date, designed to provide for a suitable reduction of the share capital of the company, with a view to the resumption of dividends.

THE PATENT SITUATION.

The patent situation has not materially changed since the last report to the stockholders. The company has secured many important patents during the year, by inventions of its engineers and experts and by purchase.

One of the Van Depoele trolley patents which had been uniformly sustained by the courts up to last summer has been adversely passed upon by the Court of Appeals for the Second Circuit. This decision was on a motion for preliminary injunction and is not final. The invention was an important contribution to the electric railway art, and no court has questioned its great merit. There is reason to believe that the technical objections to the claims of the patent, upon which was based the decision of the Appellate Court overruling that of the Circuit Court in favor of the patent, will be found upon full consideration at final hearing to be insufficient to defeat the patent.

In view of the fact that nearly all of the railway companies in the country that would be likely to use the overhead trolley system are now electrically equipped, and that the third rail and underground conduit methods are being rapidly adopted for the important new enterprises, an adverse decision in this case will have but slight effect upon the business of your company.

Many other cases based upon patented inventions of great value, including a number on the overhead trolley system, are being pressed against infringers, in which early and it is believed favorable decisions are expected.

THE DEPARTMENTS OF SALES, MANUFACTURING AND FINANCE.

Your careful attention is called to the reports of

the Vice-Presidents having these departments in charge.

Your directors desire to express their appreciation of the valuable services of your admirable engineering and commercial staff, as a result of whose ingenuity and vigilance the company has more than maintained its position of pre-eminence in the varied and constantly increasing applications of electricity.

By order of the Board of Directors.

C. A. COFFIN,
President.

FIRST VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 19, 1898.

C. A. Coffin, Esq., President General Electric Company.

Sir: I submit herewith a condensed report of the operations of the Sales Department for the fiscal year ending January 31, 1898.

Total sales (amount billed to customers).....	\$12,896,098
Cost of goods sold, general expenses and taxes, including sundry losses and allowances for losses.....	10,896,578
Profit on sales.....	\$1,499,515

From this profit should be deducted debenture interest, etc., as shown in the report of the Second Vice-President.

I stated in my last report that "the orders actually booked in 1896 were considerably less than the orders secured in 1895." As a result, we entered upon the last fiscal year with less unfilled orders on hand than usual. Our orders during the first six months of the year were far from satisfactory; the second six months showed a very marked increase in orders, and as we were not able to increase our output to such an extent as to fill these orders within the limits of the fiscal year, we enter upon the present year with a larger list of unfilled orders on hand than ever before. "Sales" include the total billed amounts for goods actually shipped. "Orders" include business secured, and become sales only when the material is shipped and billed. Our sales for 1897 are somewhat less than our sales for the previous year, while our orders are considerably in excess of the orders secured in 1896. The following figures are based on orders secured and not on sales.

LIGHTING DEPARTMENT.

We have received during the past year orders for 60,826 kilowatt capacity of arc and incandescent lighting machines as against orders for the year 1896 of 57,476 kilowatt capacity, an increase of 5.8 per cent.

Among the important lighting contracts secured during the year may be noted the equipment for the new station of the Brooklyn Edison Company and the equipment for the new station of the Boston Electric Light Company.

RAILWAY DEPARTMENT.

Orders received (money value) for railway apparatus has shown an increase of 33½ per cent. over 1896.

Orders for railway generators aggregated over 60,000 kilowatts.

The average size of the railway motor has increased to 34.7 HP., while the average railway generator for 1897 was 484.3 HP., as against 356.3 HP. in 1896.

Among the important railway contracts secured during the year may be noted the equipment of the Metropolitan Street Railway of New York City, the large motor order for the additional service of the Boston Elevated Railway (lessees of the West End Street Railway), and the contract for the substitution of electric traction for cable traction on the entire system of the Capital Traction Company of Washington, D. C. The development of interurban electric railway service has been a marked characteristic of the past year. This is well illustrated in the Cleveland and Lorain, the Akron, Bedford and

Cleveland, and the Cleveland and Eastern roads, each of which is equipped with powerful motors operated at speeds up to and at times exceeding 60 miles per hour.

POWER AND MINING DEPARTMENT.

The growth of business in the class of electrical apparatus handled by this department is strikingly shown by the following comparison of orders received for various years past:

Orders for 1893 were	36 %	in excess of orders for	1892
" " 1894	126 %	" " "	1893
" " 1895	10 %	" " "	1894
" " 1896	60 %	" " "	1895
" " 1897	60 %	" " "	1896

Orders for direct current and induction motors aggregated 19,531 HP. as against 15,171 HP. in 1896. Orders for multiphase generators aggregated 49,902 HP. as against 25,007 HP. in 1896.

Total transmission lines installed in connection with G. E. apparatus, 326 miles as against 232 miles in 1896.

SUPPLY DEPARTMENT.

The Supply Department has handled 114,229 separate orders during the year, or 43 for each working hour. The "orders received" in 1897 exceeded by 20 per cent. the "orders received" in 1896.

The supply stocks carried at our local offices have been decreased about 7 per cent. during the year, and of the present total 90 per cent. consists of active supplies, a great improvement over previous years.

The following are some of the principal articles handled by the Supply Department:

Wattmeters.—Total number ordered during the year 36,874, an increase of 42 per cent. over 1896.

Measuring Instruments.—Total number ordered during the year 3,369, an increase of 38 per cent. over 1896.

Transformers.—Total number ordered during the year 11,499, an increase of 36 per cent. over 1896.

Arc Lamps.—Total number ordered during the year 24,158, an increase of 75 per cent. over 1896.

Sockets and Receptacles.—Total number ordered during the year 2,357,649, an increase of 36 per cent. over 1896.

FOREIGN DEPARTMENT.

The orders of the Foreign Department have shown a gratifying increase over the orders for 1896. Several notable contracts have been placed with us by our foreign companies—the equipment of the Central London Underground Railway, and the equipment of the street railways in several European cities.

INCANDESCENT LAMP SALES.

The incandescent lamp orders for the year aggregated 6,857,239 of which 6,706,624 were shipped. This is an increase of about 10 per cent. over the year 1896.

The success of the Sales Department is, in a great measure, due to the administrative ability and untiring energy of the department managers, and I desire to particularly commend their good work to your notice.

Respectfully submitted,

EUGENE GRIFFIN,
First Vice-President.

THIRD VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 19, 1898.

C. A. Coffin, Esq., President General Electric Company.

Sir: I submit herewith a report on manufacturing and engineering for the fiscal year ending January 31, 1898:

MANUFACTURING.

The percentages added by the three factories to their raw material and labor in estimating factory costs have been found ample to cover all items of general expense, including a proper allowance for depreciation. The inventories have been taken with great care and counted and valued item by item.

The stock is in excellent condition and covers only apparatus and material for which the demand is constant and active.

Financial statistics relating to factory investment are given in the report of the Second Vice-President.

The press shop mentioned in my last report as nearing completion, was finished and occupied early in the year and its use has resulted in economies which more than justify the cost of its construction.

It was found necessary to increase our testing, assembling and shipping facilities by adding to our existing building an extension of 36,000 sq. ft. floor space, admirably adapted to the purposes for which it was built. The main bay is served by an electric crane of 40 tons capacity, permitting the economical loading of our apparatus directly upon the cars, which enter the building by a spur direct from the tracks of the N. Y. C. & H. R. R. and the D. & H. R. R. This addition has enabled us to concentrate our finished stock and gives the best facilities for the economical and prompt shipment of apparatus.

We have added to our Schenectady plant about 87 acres, a portion of which was covered by buildings which we are now using for manufacturing and storage purposes.

The growth of our business, together with the demand for electrical machines of increased capacity, has made inadequate our present facilities for the production of iron castings, and we are now constructing a new iron foundry containing 94,000 square feet, which should be completed during the present year.

The demands upon our engineering and drafting force have required increased facilities, which have been provided in a new drafting room, of ample size, thoroughly lighted and complete in all its appointments.

Our increased business in foreign countries has disclosed the fact that in design, cost and efficiency our machinery compares most favorably with that of European manufacturers.

Valuable data, drawings, patterns and tools necessitated by the large amount of special apparatus which we have successfully designed and manufactured in the past, are now frequently available in the construction of new apparatus, thus reducing the cost of developing such apparatus.

Our manufacturing plants at Schenectady, Lynn and Harrison have been maintained in first class physical condition. Labor-saving devices, special machinery and improved tools have been, as heretofore, added liberally whenever an improvement in the quality of the product or increased economy of manufacture would result.

ENGINEERING.

The number of undertakings requiring machinery of large capacity and special design has increased materially during the past year. This has been due largely to the application of electricity to the operation of underground, suburban and interurban railroads, and also to the concentration of power in large units due to the demonstrated economy of our three-phase machinery and the rotary converter mentioned in previous reports. A most notable and important installation is that of the underground Central London Railway which we are equipping with three-phase generators, rotary converters and thirty-two large electric locomotives.

Another remarkable undertaking is that of the mammoth new station of the Metropolitan Traction Company of New York. From this station enormous electric generators will operate, through the medium of rotary converters and other machinery of our design and manufacture, the electric street cars throughout nearly the entire borough of Manhattan.

In my last report I called attention to the value of our rotary converter, a species of connecting link between the alternating and continuous current systems, which enables existing continuous current plants to add the advantage of alternating current

generation and economical transmission to the simplicity and effectiveness of the continuous current distribution. The economies which thus result from the substitution of a single large alternating current power station for a number of small stations is well illustrated in a notable installation of such apparatus made during the past year by the Brooklyn Edison Company, using our three-phase generators, rotary converters, synchronous motors and other appliances.

The number of long distance transmission plants has greatly increased during the past year, so that we have now a total generating capacity in such plants of over 100,000 HP. and among these some 20 installations are operating at potentials of over 10,000 volts and transmitting a total of some fifty thousand horse-power to distances varying from 10 to 40 miles. The 5,000 HP. plant at Ogden, Utah, has been in operation for nearly a year, transmitting power to Salt Lake City, a distance of 36½ miles, at a potential of 16,000 volts. We have now under construction apparatus intended for the transmission of over 4,000 HP. from a distant water power 80 miles to the city of Los Angeles, Cal., at a pressure of 33,000 volts. The St. Anthony Falls plant, mentioned in my last report, has been completed and is now in regular operation, furnishing power to the street railways of Minneapolis and St. Paul, Minn.

In the city of New Orleans, La., we shall soon have in operation a novel plant of some 4,000 HP., which will be used to operate pumps for the drainage of the city. Three-phase machinery will be employed.

The driving of all machinery in cotton mills and factories by electric motors is increasing rapidly, even where the original source of power is a steam engine located in or near the mill or factory itself.

The United States Navy is adopting the electric drive in place of steam or hydraulic machinery for ventilating, pumping and hoisting on shipboard and for lowering and elevating guns and for turning turrets on the warships. This is in addition to the recognized use of electricity for lighting and small power work.

We shall soon be operating our Schenectady works from a distant water power. We have contracted for a supply of 2,000 horse-power from the Falls of the Hudson River at Mechanicsville, 19 miles from Schenectady. A novel feature of this transmission is that the generators, each of 1,000 horse-power, have been constructed by us to produce directly a pressure of 12,000 volts, thus saving the cost of the usual intermediate step-up transformers.

Our older transmission plants, such as Portland, Oregon, and Fresno, Cal., operate with great success and have largely increased their capacity, demonstrating the advantages of our system and apparatus in the electrical utilization of water powers.

There has been a great improvement in the efficiency and quality of our numerous small articles of manufacture, such as arc lamps, transformers, meters, switchboards, etc., many features of novelty and value having been developed by our engineers. Our business in this line has shown a gratifying increase.

We have continued to protect our new and important engineering designs as far as possible by application for letters patent.

The efficient work of the factory managers and the unequalled ingenuity, skill and industry of our engineers are worthy of special commendation. Respectfully submitted,

E. W. RICE, JR.,
Third Vice President.

SECOND VICE-PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 15, 1898.

C. A. Coffin, Esq., President General Electric Company.

Sir: The balance sheet and statement of profit and loss, herewith transmitted, include the assets and liabilities and profit and loss accounts of the

Edison General Electric, Edison Electric Light and Thomson-Houston Electric Companies (which, for convenience of bookkeeping, are consolidated with those of the General Electric Company) at January 31, 1898; and when "the company" is spoken of all the above mentioned corporations are included.

In explaining what each item on the balance sheet represents, the language of previous years is again used.

ASSETS.

PATENTS AND FRANCHISES.

During the year there was expended for acquiring new patents and in patent litigation, \$333,334.68, all of which has been written off to profit and loss, leaving the patents, franchises, good will, etc., of the company standing unchanged at \$8,000,000.

FACTORY PLANTS.

This account represents the real estate (lands and buildings); machinery, tools, appliances, etc.; patterns, drawings, etc.; and sundries (fittings and other small property accounts) of the manufacturing plants at Schenectady, New York; Lynn, Massachusetts; and Harrison, New Jersey.

The lands of all three plants now amount to about 160 acres and the total factory floor space of all their buildings is approximately 1,600,000 square feet.

All are free from mortgage or other lien.

These plants being a permanent investment, all expenditures for their maintenance and repair, plus an allowance to provide against depreciation, are charged to operating expenses.

A summary of the changes in this account since the last annual report is as follows:

	Book value Jan. 31, 1897.	Cost of addi- tions.	Written off for depre- ciation.	Book value Jan. 31, 1898.
Real estate.....	\$1,795,000	\$164,715.35*	\$102,670.70	\$1,857,044.65
Machinery.....	1,605,000	183,879.85	245,924.50	1,542,955.35
Patterns.....	1	71,450.87	71,450.87	1.00
Sundries.....	1	18,874.06	18,874.06	1.00
Totals.....	\$3,400,002	\$438,920.13	\$438,920.13	\$3,400,002.00
	Jan. 31, 1897.			Jan. 31, 1898.
Book value of Schenectady plant	\$2,157,000.90			\$2,300,000.90
" " " Lynn	993,000.80			900,000.80
" " " Harrison	250,000.30			200,000.30
Totals.....	\$3,400,002.00			\$3,400,002.00

*Includes full payment for 87 acres of land adjoining the Schenectady plant; cost of erecting at Schenectady a new brick and steel building 100 x 200 feet—with an annex 33 x 162 feet—for packing, storage and shipping; and cost of completing the erection (begun last year) of a brick and steel punch press shop 100 x 236 feet at Schenectady.

Includes office furniture and fixtures, horses and trucks, shop fixtures, benches, steam fitting for heating system, sprinkler system for fire protection, electric wiring of buildings, etc., etc.

REAL ESTATE.

(Other than factory plants.)

This account represents the investment in the Edison Building, 44 Broad street, New York City; also sundry parcels of land in various places, mostly improved and rented, which have been acquired at various times, chiefly in payment of debts; also a large building covering five lots on the corner of Avenue B and 17th street, New York City, which was acquired from the General Fixture Company in 1895 subject to a mortgage of \$40,000. This mortgage has been paid off during the past year.

All will be sold when opportunities offer.

STOCKS AND BONDS.

No changes of last year's figures have been made in the book valuations of stocks and bonds.

Those having a market value are carried under the price of reported sales. The book value of those not readily salable was fixed on January 31, 1897, after careful examination of their worth.

I believe the actual present aggregate value of all these securities is equal to the total amount at which they stand on the books, viz., \$7,455,872.96.

Schedule A, annexed hereto, contains a list of the most important of the company's holdings of stocks and bonds. They are carried at an aggregate book value of.....\$7,195,471.42

In addition the company owns various other securities. As their present

Amount brought forward.....\$7,195,471.42
value is doubtful and their future value speculative they are not set forth in the schedule. They are as follows:

Stocks and bonds of local lighting and street railway companies wholly owned.....	196,941.77
Sundry small holdings.....	63,327.77
Miscellaneous securities of many underlying, manufacturing, selling and patent owning corporations, and also of street railway and lighting companies, carried at one dollar for each lot—in all.....	132.00

Total book value of all stocks and bonds, as per balance sheet.....\$7,455,872.96

Sales of Stocks and Bonds.

Pursuant to the established policy of selling securities which there is no special reason for holding permanently, various stocks and bonds have been sold since the last annual report.

Their total par value was \$1,224,650.

They were sold for.....\$1,038,054.80

They were carried on the books at.....921,698.86

Profit.....\$116,355.94

The cash thus received was used towards the purchase of \$2,000,000 of the company's debentures.

CASH.

The policy of the previous three years has been adhered to and sales maintained on a basis of cash or short credit to desirable customers.

None of the money realized from the sale of assets was required for the current business of the company during the year.

NOTES AND ACCOUNTS RECEIVABLE.

This account represents the total amounts now due the company by its customers.

They appear in the balance sheet at an estimated realizable value (i. e. their face, less a total allowance of \$662,614.66 for possible losses) which I believe to be a fair one.

They may be classified approximately as follows:

	Face values.	Face values.	Face values.
Current notes.....	\$987,685.56		
" " accounts.....	2,522,554.95		
		\$3,510,240.51	
Slow notes.....	921,779.71		
" " accounts.....	583,094.63		
		1,504,874.34	
			\$5,015,114.85
Due from local lighting and street railway properties wholly owned by the company..			184,544.69
Total face value*.....			\$5,199,659.54

*In addition, there yet remain—of old notes and accounts receivable which two years ago were written off to profit and loss, except the nominal book value of one dollar for each debtor—notes and accounts of 256 debtors aggregating \$1,724,614.18. These stand on the books at \$256, and are being liquidated as rapidly as possible. The total amount realized from settlements of similarly valued notes and accounts during the past year was \$84,354.17. Total face value as above \$5,199,659.54 + "Dollar" notes and accounts \$256 — allowance for losses \$662,614.66 — total book value, as per balance sheet, \$4,537,300.88.

WORK IN PROGRESS.

This account does not include outlays for anything in process of manufacture; but represents expenditures outside of the factories for labor, material, etc., on 229 installations of manufactured apparatus delivered at various places.....\$363,487.85
Less partial payments thereon, received under the terms of the contracts as work progressed.....79,655.86

Balance.....\$283,831.99

None of the estimated profit to be derived from these installations is included in the earnings of the year, and no allowance is made thereon for possible loss.

INVENTORIES.

These accounts represent raw materials and goods manufactured and in process of manufacture at the factories; manufactured goods in storerooms of local offices and on consignment; office furniture, fixtures,

instruments, etc., in the general office and in local offices; tools and materials in local repair shops; and also shipments in transit to local storerooms.

All have been counted and valued item by item.

Raw materials have been valued at the market prices prevailing on January 31, 1898; active selling finished and partly finished apparatus and supplies at factory cost; inactive or slow selling apparatus and supplies at about 50 per cent. of factory cost; obsolete apparatus and supplies at scrap value; and tools, instruments, furniture, etc., at present value.

On the above basis, the inventories of the factories showed an excess over book value of \$275,097.72, which is not taken as a part of the year's profit, but is retained as a reserve.

All other inventories showed a shrinkage from book value of \$79,238.39, which has been written off as a loss for the year.

Goods are taken in and out of local office inventories at factory cost at the time being.

The bulk of the above shrinkage is due to factory costs at January 31, 1898, being lower than at January 31, 1897, and to writing down the book value of slow selling apparatus and other personal property.

CONSIGNMENTS.

Finished apparatus for novel uses has been delivered to various concerns, subject to purchase if its operation is successful. The greater part of this account represents such contingent sales, and the remainder represents apparatus on exhibition or loaned to regular customers for temporary use by them.

All the above apparatus is charged, at factory cost, to this account at a total of.....\$80,771.48
Less allowance for depreciation.....28,036.69

Net book value of consignments.....\$52,734.79

LIABILITIES.

The company has no notes payable, nor is any paper bearing the company's endorsement or guaranty under discount.

All purchases have been paid for in cash.

It has not been necessary to borrow money, nor has the company's credit been used during the year either by issuing notes, endorsing customers' paper for discount or lending its name in any way.

DEBENTURES.

During the year the company has purchased and canceled \$2,000,000 of its own 5 per cent. gold coupon debentures due June 1, 1922, at an average cost of 99.30 per cent.

ACCRUED INTEREST ON DEBENTURES.

This account, as its name implies, is the full amount of 5 per cent. interest accrued to January 31, 1898, on the company's \$6,000,000 outstanding debentures.

ACCOUNTS PAYABLE.

This account includes all unpaid audited indebtedness.

At the close of business on January 31, 1898, there were no unpaid vouchers on hand.

The amount of accounts payable shown in the balance sheet, \$263,525.75, represents expenditures belonging to the year, vouchered between January 31 and February 26, the date of closing the general books. The amount of vouchers which have to be carried over in this way monthly, owing to keeping the books—other than the cash book—open a sufficient time to include expenditures of a particular month in that month, is usually about \$500,000.

RESERVE FOR EXTENSIONS TO FACTORY PLANTS.

This account represents \$250,000, set aside, from the profits of the business of the past year, toward the cost of erecting and equipping at the Schenectady plant an iron foundry and a machine shop which are estimated to cost about \$500,000.

Contracts for the iron foundry have been let and work under them has begun. The plans for the machine shop are being prepared.

Respectfully submitted,

J. P. ORD,
Second Vice-President,

We have made a critical examination of the books and accounts of the General Electric Company, the Edison General Electric Company, the Edison Electric Light Company and the Thomson-Houston Electric Company, for the two years ended January 31, 1898, and hereby certify that the consolidated in-

cautions taken to enter all existing current liabilities on the books at the time of closing, and are satisfied that all known accounts payable of the company are included in the balance sheet.

We have read the explanations of the balance sheet and profit statements submitted herewith by the Second Vice-President and concur therein.

PATTERSON & CORWIN,

Certified Public Accountants.

RIVETING BY ELECTRICITY.*

BY F. VON KODOLITSCH.

Most of the shipbuilding yards and bridge-building establishments are now seriously considering the question of introducing electric transmission of power into their works for the sake of driving each tool by a separate motor. Some of the factories already possess a hydraulic installation for riveting purposes which it would be impossible to convert to the new system. The only way of applying the new system to the existing plant would be to drive the compressor pumps by a separate electric motor. All the defects which belong to hydraulic installation in general would adhere to this, viz., a great outlay of capital, high working expenses, and an enormous cost in the up-keep. For the last two years I have been experimenting on electric riveting machines, and have finally succeeded in bringing out a type of riveting machine quite capable of superseding the two systems already existing, viz., hydraulic and pneumatic riveting. There are a good many firms in this country who have to decide which system of riveting they intend to adopt for the future, in order to keep pace with the rapidly-increasing competition of other firms at home and abroad, and this is the reason that I propose to read a paper on this subject at the present meeting, especially as I have seen that some firms on the other side of the Atlantic are making great efforts to introduce the pneumatic system, and promise gigantic profits to those who decide to adopt it.

Before I proceed to describe the electric riveter in detail, I wish to point out, in a few remarks, why the electric system is, from the commercial and technical point of view, superior to all its rivals. I assume, of course, that the yard adopting the new system already possesses a central station and a system of wires for transmission of power, as is already the case in a good many establishments. If they are driving punching, shearing or boring machines, rolls or mangles, etc., by the electric current, it is certainly logical to utilize this existing current also for riveting. Anyone deciding to rivet by electricity has only to order such a machine and place it where he wants to do his riveting, connect two wires from the main to the riveter, and he can begin the operation at once.

Now let us suppose hydraulic riveting has been decided upon. A pair of expensive compressor pumps have to be installed, a gigantic accumulator has to be put up, pipes must be laid, pipe connections between the riveter and the accumulator have to be made, and a hydraulic riveting machine must be bought and erected. In case of pneumatic riveting the same installations must be made, and almost the same outlay of capital is incurred. What has been said above clearly demonstrates that the initial outlay is far less if the electric system be adopted. Everyone who works a hydraulic or pneumatic installation must know what a heavy item is the keep-up in the total working charges. In case of the electric system, this point only becomes a fraction of the expenditure. As regards the quality of the work, there is not the slightest difference, but as regards the quantity of work done, the electric system is considerably superior. The machine I am describing to-day has closed, for weeks and weeks, 1,200 rivets

in a day of ten hours' duration, requiring the attendance of only three men and a boy.

The electric riveting machines which have up to the present been built can be carried about easily to any place in the yard, but are not made for being suspended from a crane. To the large jaw are attached two platforms at right angles, so that the riveter may be used horizontally or vertically. The system is so very simple that I need not occupy much of your time in describing it. One heavy disk is always rotating by electricity, whether the riveter is closing rivets or not. This disk can become, at the same time, an electro-magnetic coupling, so that when the current is passing this coupling a second disk, keyed on to a screw spindle, may be at once firmly attached to the revolving disk, thus the friction of the screw spindle can be regulated according to the operator's wish. The screw spindle moves a large nut at the end of a knuckle joint, which raises and lowers the die for making the rivet head. Between the already-mentioned disks a conical friction roller can be inserted. By pressing in this roller, the motion of the screw spindle can be reversed, and the nut of the knuckle joint returned to its original position in order to be ready for a new stroke. The pressure on the die must be regulated in proportion to the diameter of the rivet, and this is done by producing more or less friction between the two disks, which difference in friction is obtained by more or less current being admitted to the electro-magnetic coupling. The type of riveting machine which we are building now is made chiefly for shipbuilding purposes, and closes rivets up to 1½ in. in diameter; the output is, as already stated, 120 rivets per hour. When so many hot rivets are required in a short time the question of heating the rivets becomes very important. When we started to rivet by electricity, we could not produce the number of hot rivets required by using a reasonable number of portable forges. For this reason we have made a small fan, driven by an electric motor, to supply air to a number of small furnaces, which considerably reduces the number of boys required for heating rivets.

American Institute of Electrical Engineers.

The 124th meeting of the Institute was held at 12 West 31st street on Wednesday evening, April 27, Mr. H. Ward Leonard in the chair. About 60 members and guests were present. A paper on "An Economy Test of Central Stations" was presented by Prof. W. E. Goldsborough of Lafayette, Ind.; also a paper on "A Novel Form of Thermo-Electric Battery," by C. J. Reed of Philadelphia, which was accompanied by experiments. The discussion was participated in by Messrs. Cox, E. P. Thompson, Mailloux, Reed, Wintringham, Steinmetz, and Mr. W. M. Mordey of London.

At a meeting of the Executive Committee in the afternoon the following associate members were elected:

Wyatt H. Allen, San Francisco, Cal.
Wm. H. Fitzhugh, Bay City, Mich.
John Breckenridge Fleming, Austin, Nev.
Geo. J. Henry, Jr., New York City.
N. S. Hopkins, Schenectady, N. Y.
Robert Lindsay, Cleveland, Ohio.
Fred'k A. Muschenheim, New York City.
Newton L. Schloss, New York City.
Clarence M. Tolman, Silverton, Col.
Ernest Stiles Vinton, New Haven, Conn.

An Important Deal Closed.

We learn that Mr. J. E. Keelyn, President of the Western Telephone Construction Company of Chicago, has just closed a deal for control of the Graham Electric Company's telephone and switchboard business as well as all of its patents. It is said this is the fifth concern that has been arranged for in like manner recently. A strong combination seems to be imminent with Mr. Keelyn as president, and a strong financial syndicate backing it.

LEGAL NOTES.

In the suit brought in Brooklyn, N. Y., by Hugh V. Roddy and Valentine Schmitt to restrain the Brooklyn Heights Railroad Company and the Coney Island & Brooklyn Railroad Company from running their cars which cross the bridge in Washington street, on the ground that the railroad companies had not acquired the right to run the cars under the agreement which they had made with each other, and that the street would be so blockaded by the additional cars that the businesses of the plaintiffs would be injured, Justice Maddox of the Supreme Court has rendered a decision in favor of the railroad companies. Under this decision a railroad company has the right to lease and use the tracks of another company, and to operate cars thereon without obtaining the consent of abutting property owners. At the close of his opinion Justice Maddox says: "My conclusion is that the right of the defendants to contract for the use of their respective roads and to operate cars thereon was a vested right, not dependent for vitality or authority upon any law enacted since the constitutional amendment of 1874, and the exercise of that right is not violative of any constitutional provision."

Judge Mitchell at St. Paul, Minn., has reversed the order of the lower court in the libel case brought by Senator S. D. Peterson against the Western Union Telegraph Company. The syllabus of Judge Mitchell's decision is as follows: "A written message, alleged to be libelous, was delivered to defendant's operator at New Ulm and by him transmitted by sound over the wires to the operator at St. Paul, to be by him reduced to writing and delivered to the plaintiff. Held, that this constituted a publication of the libel. Mere negligence, unless so gross as to amount to positive bad faith, is not a ground for awarding punitive damages. Hence an instruction to the effect that the jury might award exemplary damages if they found that the defendant was negligent in employing the operator who transmitted the message, or in failing to adopt proper rules to prevent the transmission of libelous messages, is erroneous. Order reversed."

Bids Wanted for Telegraph Material.

The U. S. Department of Agriculture has called for bids for furnishing the Department with telegraph material. It is estimated that during the year it will need 6 cable arresters; 1,300 battery recharges for Gordon primary; 30 cells, dry imperial; 1,000 primary Gordon batteries; 25 cells Le Clanche batteries; 500 Nungesser batteries; 500 Edison Lalande; 500 renewals for Edison Lalande batteries; 40 electric bells; 6,000 lbs. blue vitriol; 500 insulator brackets; 50 battery brushes; 50 push buttons; 50 electric buzzers; 200 finished connectors; 500 coppers, gravity battery; 8 dozen cutouts, K.W.; 1,000 screw glass insulators, double petticoat pattern; 200 porcelain insulators; 12 telegraph keys; 200 incandescent lamps; 5 pairs of lanterns, marine signal, electric; 10 box sounding relays; 18 telegraph relays; 6 dozen electric light shades; 5 dozen electric light shade-holders; 10 giant telegraph sounders; 10 plug out-out switches; 10 wooden bore switches; 40 dozen Hort or equal switches; 15 lbs. telegraph tacks; 16,500 feet of wire; 40,980 lbs. of wire, and 525 spelter zincs, and 30 sheets of zinc.

Annual Meeting of the Joseph Dixon Crucible Co.

The annual meeting of the stockholders of the Joseph Dixon Crucible Company was held at the company's main office, Jersey City, N. J., Monday, April 18, and out of a possible vote of 7,345 shares there were 7,042 shares voted for the re-election of the old board, consisting of Edward F. C. Young, John A. Walker, Daniel T. Hoag, Richard Butler, William Murray, Alexander T. McGill, and Joseph D. Bedle. President E. F. C. Young, Vice-Pres. and Treasurer John A. Walker, and Secretary Geo. E. Long were re-elected by the directors. Judge Joseph D. Bedle was also re-elected as counsel.

* Abstract from the *London Electrician* of a paper read at the Institution of Naval Architects.

CANADIAN NOTES.

It is understood that the Consolidated Electric Light Company of Victoria, B. C., are preparing to utilize the water power at Goldstream for the operation of the electric lighting and railway system. The work will cost upwards of \$100,000.

The Hess Metallic Furniture Company have begun the erection of a large factory at Niagara Falls, Ont., and probably will be the first company to use electric power developed on the Canadian side for manufacturing purposes. The Carborundum Company, one of the largest users of electric power on the American side, it is said, are about to close a deal for a building site near the former company, and will begin building before the first of June next.

The Cataract Power Company has made a proposition to pump the water supply of the city of Hamilton, Ont., by electric power. They agree to erect at the beach pumping-house, electric motors and revolving screw pumps of sufficient capacity to pump 10,000,000 gallons per day, and to erect at the high level pumping-house, motors and pumps and supply sufficient power to pump from the mains to the high level reservoir 2,500 gallons per day. The company will keep the pumps in operation for one month, when the city will be expected, if satisfactory, to pay for them at the ascertained price, not to exceed \$25,000. The price to be paid by the city for electric current necessary for pumping the water required is placed at \$13,000 per annum for the first 1,600,000,000 gallons pumped in both reservoirs, and 60 cents for each additional 100,000 gallons. The company claim that their offer will meet the requirements of the fire underwriters, and save the city more than \$20,000 per year.

THE NEWS.

What Is Going On in the Electrical World.

STREET RAILROADS.

Bound Brook, N. J.—The Piscataway township committee has been offered \$5,000 for the franchise to build a trolley road over the route between Bound Brook and Dunellen. The offer was made by Silas D. Drake, in behalf of the Lincoln Trolley Company, which is to be capitalized at \$25,000.

Boulder, Col.—Denver architects are preparing plans for a tabernacle with a seating capacity of 6,000 people to be erected on the grounds of the Texas-Colorado Chautauqua Association near Boulder. Arrangements have been made for an electric street railway line running from the depot direct to the grounds, to be in operation by July 4, the opening day. The entire grounds will be lighted by electricity.

Cedar Falls, Ia.—The city council at its last meeting passed a resolution adopting the Patton motor system as the street car power in Cedar Falls.

Cheboygan, Mich.—Mayor Maloney is a strong advocate of the proposed trolley road from Cheboygan to Petoskey by the way of Dodge's Point, Mullet Lake, Topinabee, Indian River, Burt Lake and Oden.

Chicago.—The "Tribune" says: "At a recent meeting of the directors of the Michigan, Indiana & St. Louis Electric Railway Company it was decided to proceed with the building of the road at once. The enterprise will be financed by an Eastern syndicate, but several Chicago men are interested in it, and the company's office will be located at 59 Dearborn street. William Sear is president and F. M. Gilmore general manager and superintendent of construction. John Moffet, attorney for the company, said the work of building would begin at Monticello, Ind., and proceed both ways from that town, connecting the towns of Rochester, Pulaski, Headley, Buffalo, Norway, Monticello, Chalmers, Brookston, Fowler and Dunnington, in Indiana. The road will be eighty miles long and may be extended later. The road will be equipped with both passenger and freight cars, with powerful electric motors. It is proposed to do a general passenger and freight business, including the handling of live stock."—The North Chicago Street Railway Company has posted notices in its car barns informing the employees that any of them who were desirous of enlisting in the United States service for the war would have their places held open, receive half of their regular salaries and a life insurance of \$2,000.

Columbus, O.—The county commissioners have granted a franchise to Adam T. Grant for an electric railway from Green Lawn Cemetery to Grove City along the Harrisburg pike. The franchise is to run for 25 years.

Hamilton, O.—The Hamilton Belt Line Railway has

increased its stock from \$25,000 to \$50,000, and the immediate construction of the road is determined upon.

Joliet, Ill.—The stockholders and directors of the Joliet Street Railway Company have sold the line to the Joliet Railroad Company for \$600,000. The line includes five branches inside the city and a line five miles long to Lockport. The new company will spend \$100,000 in extensions this year. The officers and directors of the Joliet Railroad Company are: W. F. Milliken, Portland, Me., president; George F. Duncan, vice-president, Portland, Me.; Edward Woodman, secretary, Portland, Me.; Henry P. Cox, treasurer, Portland, Me. Directors: Walter Davies, George F. Duncan, Weston F. Milliken, Edward Woodman, John Burnham, Clinton; L. Baxter, manager, William McKinley, Champaign, Ill.; C. C. Rush, superintendent, Joliet.

Lynchburg, Va.—Arrangements, it is said, have been made to rehabilitate the street railway formerly belonging to the Lynchburg Electric Company.

Milton, Pa.—A trolley road is likely to be built this summer between Danville and Bloomsburg. The matter has been agitated for some time and two separate companies have at different times received franchises and the right of way to build the road, but want of funds blocked the scheme. A Philadelphia party has now taken hold of the matter and will probably carry it through.

Newport News, Va.—The city council has granted a franchise to the Newport News, Hampton & Old Point Railway and Electric Company, permitting it to construct and operate a street railway in this city.

Newport, Ky.—Col. R. W. Nelson is said to be in New York in the interest of the proposed new street railway company which is talked of to operate a line over the Central Bridge, through Newport and Bellevue to Dayton. He is endeavoring to interest capitalists in the new venture, and while the war excitement has greatly interfered with his plans, he expects to succeed.

Oakland, Cal.—The Alameda, Oakland & Piedmont Electric Railway Company has been granted a franchise permitting it to run street cars in specified streets in Oakland.

Shelburne Falls, Mass.—The Shelburne Falls & Colrain Street Railway Company has decided to add \$7,000 to its capital stock and to issue bonds to that amount for the purpose of extending its tracks into the town of Buckland to connect with the Fitchburg Railroad.

LIGHTING PLANTS.

Albany, Ga.—At the special election held here on the 18th ult., for the purpose of determining whether the city should issue \$25,000 of bonds for purchasing and improving the plant of the Albany Edison Illuminating Company, the vote stood—for, 235; against, 23.

Columbus, O.—The system of lighting the streets by arches of incandescent electric lights has proved successful here and a party of Cincinnati business men who visited Columbus lately to examine this method of street illumination were so pleased with it that they have recommended its adoption on Fourth and Fifth streets in their city. The system of arches used in Columbus, on High street, is unique and unlike any other in existence.—Senator Voight's bill authorizing villages to lease electric light plants has passed the House.

Eldora, Col.—Attorney A. B. Tomlin has gone to Colorado Springs for the purpose of meeting the stockholders of the proposed electric light and power company which is to be put in a plant at Eldora soon. The plant purchased has cost about \$62,000 and will have a capacity of 500 horse power.

Decatur, Ill.—A proposition is under consideration to sell the city electric light plant to a local company. The bidder offers to supply the necessary light 10 per cent. cheaper than it is said to be possible for the city plant to produce it.

Gallatin, Tenn.—An election is to be held here on May 7 to get a public vote on the question of electric lights and waterworks for the town.

Hinesburg, Vt.—There is a popular movement here in favor of putting in an electric light plant.

Joliet, Ill.—L. E. Ingalls, who owned a one-third interest in the Economy Light & Power Company of this city, has sold his stock to John J. Mitchell, president of the Illinois Trust and Savings Bank of Chicago. The capital stock of the company is \$450,000.

Manning, Ia.—The city council is in favor of bonding the town for the purpose of putting in an electric light plant, and a special election will probably be called soon to vote on the proposition.

Mingo Junction, O.—A company is to be organized here to put in an electric light plant.

New Painesville, Minn.—At a special election held here on the 25th ult., the proposition to issue \$3,000 in bonds for waterworks and electric lights was carried by a vote of 56 to 31.

Rochester, Minn.—There were 17 bids opened on the 22d ult. for enlarging the electric light plant. The National Electric Company of St. Paul got the contract at \$7,796.

San Francisco.—The supervisors have adopted the plan of the Merchants' Association for lighting the city by districts, but they have also adopted a resolution

prohibiting the erection of additional poles to carry electric light wires. This latter resolution effectually debars competition with the Consolidated Gas & Electric Company, which now has the contract for street lights. Representatives of the Mutual Electric Company appeared before the supervisors and offered to light the streets for \$40,000 a year less than the present cost, provided it were allowed to erect poles in the outside districts.

Stockton, N. J.—The Stockton Electric Light & Power Company have accepted the terms of the ordinance recently passed by the town council, permitting them to erect poles, wires, etc., for supplying the town with electric lights, and will shortly commence work on their new system.

St. Paul, Minn.—Plans for an electric lighting plant for this city have been prepared by Building Inspector Hass at the request of a special committee from the city council. The plant, complete, will cost \$200,000. The building will be 42 x 113 and will contain dynamo and boiler rooms, together with quarters for the superintendent and electrician. There will be six 100-horsepower engines, each capable of producing 100 arc lights of 2,000 candle power. The committee is authorized to advertise for bids for the construction of the plant.

Yale, Mich.—The proposition to bond this village for \$20,000 to put in waterworks and an electric light plant was carried by a good majority at the special election held here on the 20th ult.

MANUFACTURING, ETC.

Allegheny, Pa.—Sealed proposals will be received at the office of the city comptroller until Monday, May 9, 1898, at 12 noon, for furnishing the city of Allegheny with underground cables and accessories for the fire and police telegraph systems. Specifications can be had on application at the office of the superintendent of the Bureau of Electricity. A bond to the amount of \$10,000 must accompany each proposal. The Committee on Public Safety reserves the right to accept or reject any or all bids.

Columbus, O.—Senator Miller has introduced a bill looking to a practical test of electricity as motive power for canal boats. It authorizes the State Board of Public Works to grant a permit to any company to make the experiment upon the Miami & Erie Canal by the erection of poles, wires or other apparatus for the propulsion of its boats. If any other company or person wishes to send boats over the canal by electric power the company having the electric power apparatus shall be able to furnish the power asked for, charging therefor a proper fee. The Toledo "Blade" says it is understood that if this bill passes there is a company that is ready to at once put into operation a line of electric canal boats on the northern end of the Miami & Erie.

Detroit, Mich.—The Ideal Manufacturing Company and the Electric Gas Stove Company have combined and the amalgamated companies will be known as the Ideal Manufacturing Company. The capital stock of the new company is \$250,000. In addition to the lines formerly manufactured by the Ideal Company, the new concern will make electric gas heating stoves, ranges, broilers, gas grates, etc. The officers of the new company are: President, James N. Wright; vice-president, Hiram T. Bush; secretary, Frank T. Dwyer; treasurer, John H. Bissell.

New York.—Elmer P. Morris, 15 Cortlandt street, is said to have received an order for designs for some expensive machines for a large electrical manufacturing plant that has been recently established in Johannesburg, South Africa. These are wanted as samples for future orders.

Rochester, N. Y.—The Federal authorities have placed an order for 200 large searchlight mirrors with the Bausch & Lomb Optical Company of this city, and that company is working night and day to fill the order. The war has had the effect of bringing to notice the fact that lenses sufficiently strong for searchlights could be made in this country. All the vessels and forts of the United States are equipped with searchlights, but the equipment was not sufficient for war.

TRANSMISSION PLANTS.

Oneida, N. Y.—Judson W. Warner has secured control of the water privilege and the old Kent mill near Wampsville, and holds a franchise for a transmission line from that point to Oneida. He intends to develop the water power, erect an electric generating plant and transmit power to Oneida and other places. It is expected that the new plant will be in operation in the early autumn.

Winston, N. C.—The power of the Yadkin river is now being transmitted by electricity to Winston-Salem. It is the only enterprise of the kind in North Carolina. The plants now being operated by this power include Fries' woolen, cotton and flouring mills. The South-side cotton factory, the street railway and electric light plant and Fogle Bros. planing mills will be connected immediately. The development of this enterprise was inaugurated last year by the Fries Manufacturing & Power Company of Salem. The mechanical plans were prepared by Charles R. Makepeace & Co., of Providence, R. I., and the electrical plans by Lewis & Clafflin, of the same place. The present development represents 1,000 horse-power, but the buildings have capacity for another line of eight turbine wheels and another generator of sufficient capacity to utilize the entire water-flow at this point of the river. The electricity is generated and transmitted at 10,000 volts.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—Governor Black has signed the bill of Assemblyman Hoes to incorporate the Jansen-Kill Electric Power Company of Hudson. This company proposes to build and operate a number of dams and reservoirs in Dutchess and Columbia counties for developing and furnishing electric and hydraulic power for manufacturing and other purposes, and transmitting such power to a distance by electricity and other means to Hudson and other places. The incorporators named are: William A. Harder, Jr., Philip M. Harder, and Charles N. Harder. The capital stock of the corporation is placed at \$100,000.

Mechanicville, N. Y.—The Hudson River Power Transmission Company is now placing the dynamos at the new dam. The contracting company expected to start in on a large contract at Augusta, Ga., when they had finished here, but news has been received to the effect that operations will not be begun there until the war troubles are over.

Schenectady, N. Y.—The superintendent of the lighting department of the General Electric Company, S. Dana Greene, is a lieutenant of the New York Naval Reserve, and as such received orders to report at the Naval Reserve ship New Hampshire, at the Brooklyn Navy Yard, for assignment to active duty. Lieutenant Greene, who responded at once, has been assigned to duty on the Yankee as executive officer of the ship, being second in command. The crew of the Yankee consists of 87 men.—William Davis, who is suspected of being connected with the murder of Mr. Blodgett, counsel of the General Electric Company, has escaped from the Washington County jail.

Waterford, N. Y.—The Highway Commissioners have granted the application of the Stillwater and Mechanicville Railway Company for the privilege of laying tracks on the highway. The privilege was granted on condition that the company pay \$2,500 for widening the road. The commissioners granted the request of the railway company to lay T rails part of the distance.

PERSONAL AND MISCELLANEA.

C. V. Boughton, of Buffalo, N. Y., the inventor of the telephotos, was called to Washington a few days ago by the War Department, and after a conference with the officials an order was given him for sets of the telephotos to be erected at the fortifications at New York, Boston, Fortress Monroe, Key West and San Francisco. It is the plan of the War Department to place at each of the fortifications on the coast a set of the telephotos, so that news, instructions and general communications can be transmitted by night as well as by day between the army fortifications, which will be in telegraphic connection with Washington, and the fleets or vessels of the navy which may be under the guns of the forts, or in the adjacent waters.

James E. Morris, a young inventor of promise, died at his home in Chester, Pa., on the night of the 22d ult. Mr. Morris was the inventor of several electrical devices, among them the incandescent arc lamp bearing his name, which a company was recently organized to manufacture.

Miss Sylvia Bidwell, daughter of Benson Bidwell, the electrical inventor, is at the head of a theatrical company now performing in the West. Mr. Bidwell is at present a resident of Chicago, and is patiently awaiting the decision in a long pending suit to determine his claim to the patent covering the electric trolley poles now in general use.

Hon. Frank S. Stevens, of Fall River, Mass., who died at Swansea, Mass., on the 27th ult., was one of the most prominent business citizens of Fall River, and also socially one of the most popular. He was a director in many large enterprises, mills, print works, etc., and was deeply interested in the development of electrical industries, being at the time of his death president of the Fall River Electric Light Company and director of the Dartmouth and Westport electric road, the Union Street Railway of New Bedford, and the Globe Street Railway. The Fall River "Globe" says of him: "Perhaps there is no man whose demise would leave a wider breach in business and social circles in Fall River, and to Swansea the loss will be an irreparable one."

President George A. Fowler, of the Fowler Packing Company, Kansas City, Kan., has offered the State University \$18,000 to construct an entirely new electrical engineering building if the regents of the university agree to provide \$20,000 for new machinery and equipments. The Topeka "Capital" in announcing the generous offer of Mr. Fowler says: "It has evidently not escaped the notice of this successful business man that the University of Kansas is making notable strides to the front of American colleges in its electrical department. Under the direction of Prof. Blake the electrical work of the university has stood second to none perhaps in the United States, and certainly none in the West. It has attracted the notice of the most eminent electricians in other countries as well as our own, and has received distinguished recognition from the National Government."

A special to the Pittsburg "Dispatch" from Butler, Pa., states that the electric machine invented by Frank Flannegan, of Washington, D. C., has successfully been tested in three oil wells at Bruin. The machine boils out the paraffin in old wells that have been clogged and makes them produce all the oil that is in them. The first trial was made at Bruin on three old wells that were producing about one barrel each per day, and one of them

less than that amount. They were all subjected to an intense heat for several hours, with the result that the flow of oil was increased from three to five fold.

COMMERCIAL PARAGRAPHS.

Lubrication of Gas Engine Cylinders.

The proper lubrication of gas engine cylinders has been a very difficult problem. The problem, however, seems to have been very successfully solved by an official of the Pennsylvania Railroad Co. He writes as follows:

"I had a gas engine at Sharon, Pa., running a pump, and the man that had charge of it allowed the lubricator to run dry and cut the piston, piston rings and cylinder. The makers of the gas engine said the cylinder would have to be sent to the shop and bored out and a new piston put in. It was our busy season and we could not do without water. I had some of Dixon's finely pulverized graphite, and I commenced to feed it into the cylinder through the suction pipe with the air and gas with immediate relief. After about two weeks the engine was running smoothly and using less gas than ever before.

"I had this same engine apart last Saturday, and every place that was cut is smooth as glass. This one instance saved us about \$75.00. I have great faith in this graphite and always keep it on hand."

Educate Your Bowels With Cascarets.
Candy Cathartic, cure constipation forever.
10c, 25c. If C. C. C. fail, druggists refund money.

Don't Tobacco Spit and Smoke Your Life Away.

To quit tobacco easily and forever, be magnetic, full of life, nerve and vigor, take No-To-Bac, the wonder-worker, that makes weak men strong. All druggists, 50c or \$1. Cure guaranteed. Booklet and sample free. Address Sterling Remedy Co., Chicago or New York.

Warning to the Trade—Look out for the Label.

Irresponsible parties are offering a lamp to the trade labeled "Warren." We suggest the name "Cuckoo" as a better name as the bird of that name shows the same characteristics as the parties behind this lamp. See that you get what you order. Our lamps are all labeled as follows:

THE WARREN ELECTRIC & SPECIALTY CO.,
Warren, Ohio.

Sixteen Good Reasons.

The Ward Leonard Electric Company are publishing the following sixteen reasons why their Circuit Breaker is the best one:

1. It is the surest to open on overload current, having two independent switches held by independent latches either of which will open the circuit with a double carbon break.
2. It is impossible to close the circuit breaker when an overload condition exists on the circuit. The two sides being closed independently, the switch first closed always automatically opens the circuit if the first switch be closed upon overload or short circuit.
3. No auxiliary knife switch is required in series with this circuit breaker in order that the operator may safely close the circuit breaker without the risk of being burnt.
4. There is no chance of either switch sticking or failing to open because, as soon as the latches are released the switch parts receive a strong hammer blow while the springs are tending to push the switches open. This entirely overcomes the friction of rest under the worst conditions conceivable.
5. There is no chance of the plunger "fleeting" as is met with in the case of the open coil types. With our Iron Clad Solenoid Magnet the magnet pull when the plunger engages the latches is much stronger than in other types. The magnetic section alone, without any hammer blow of plunger on latches, will release the latches in our circuit breaker with much less than the minimum current at which it is rated.
6. The friction of the latch is "rolling friction" instead of the "sliding friction" met with in all other circuit breakers. Our 2,000 ampere circuit breakers can be readily tripped by hand with a light pressure.
7. These circuit breakers require no auxiliary levers to close them even in the largest sizes. The division of the work of closing into two parts, and the perfect smoothness of the switch contact, make it readily possible for any operator to close the largest circuit breakers without effort.
8. There is no chance whatever of the operator or other person being hit by the circuit breaker when it opens, as the circuit breaker is so designed that it does not extend outward from the switchboard any further when open than it does when closed. The maximum distance it extends from the switchboard is about one-half of the distance taken by other makes.
9. The switch contact of this circuit breaker is the most perfect ever produced in any kind of switch. Under all conditions there is perfect flexible contact between surfaces absolutely parallel. There is no "wedge action" as in all "knife-blade" types of switches. The perfection and reliability of contact is unequalled by any other switch. It

is impossible for one blade to in any way affect the contact of any other blade.

10. We allow 50 amperes per square inch of switch contact surface in rating the switches. But because of the perfection of contact in our form of switch 75 amperes per square inch causes no more heating than 50 amperes per square inch in the switch of "knife-blade" type.

11. All parts of these circuit breakers are made to gauge by the highest class of special tools and are absolutely interchangeable. A new part can be put into the circuit breaker by any user. No possible accident will make it necessary to return the circuit breaker to the maker.

12. The switch blades are not "sweated in" as usual, but can be removed by loosening one nut. In the worst possible case of burning of the switch, new switch blades can be sent by mail and inserted in place of the old ones in five minutes after receipt.

13. The circuit breaker can be readily tripped by hand at any time with the greatest ease and with perfect safety.

14. This circuit breaker occupies less room on the switchboard than any other of comparable capacity.

15. The circuit breaker is finished throughout in polished copper and is the handsomest circuit breaker made both as regards design and finish.

16. Last, but not least, this circuit breaker can be manufactured much cheaper than any other, and hence you can buy it for much less money than any other circuit breaker you would consider in competition with it.

To Cure Constipation Forever.

Take Cascarets Candy Cathartic. 10c or 25c.
If C. C. C. fail to cure, druggists refund money.

No-To-Bac for Fifty Cents.

Guaranteed tobacco habit cure, makes weak men strong, blood pure. 50c, \$1. All druggists.

Removals.

The Stanley Electric Manufacturing Company have removed their New York offices from 39 Cortlandt street to the Empire Building, corner Broadway and Rector street, where they have found quarters much more commodious and better adapted to the conditions of their growing business. The new offices are on the tenth floor at the Broadway corner of the building, are very light and pleasant and easily and quickly reached by means of well-managed elevators.

Edward P. Thompson, Solicitor of Patents, has removed his New York office to 81 Fulton street, corner of Gold, where he will be in the same suite as his associate legal counsel, Alfred C. Coursen. As formerly, Mr. Thompson's specialty will be Solicitor of Patents and Consulting Electrical Engineer. Being in the same suite with Mr. Coursen, the business of patent suits will be greatly facilitated. Professor Anthony continues to act for the firm as associate technical counsel.

The firm of Dickerson & Brown removed on May 1 to the Washington Building, 141 Broadway, New York.

Geo. W. Patterson, in a note dated Chicago, April 27, reports that on or about May 1 the two companies he represents—the American Circular Loom Flexible Conduit and the Gordon, Law and Phoenix Batteries—would remove from 1,114 to 1,539 Marquette Building Chicago, and he invites all old friends and customers to come up and have a birdseye view of the city. "The conduit business," he says, "was never so good before, and is increasing, while the merits and especially low prices of the Phoenix batteries are beginning to be recognized in a very flattering manner."

The Packard Mogul Lamp continues to stand alone in the field as the largest successful incandescent lamp. The trade has settled down quite generally to the 300 candle-power size and this is now being used very extensively for lighting where large units are required. It is an interesting fact that a large number of the first Mogul lamps that were made a great many years ago are still burning and giving good service.

Everybody Says So.

Cascarets Candy Cathartic, the most wonderful medical discovery of the age, pleasant and refreshing to the taste, act gently and positively on kidneys, liver and bowels, cleansing the entire system, dispel colds, cure headache, fever, habitual constipation and biliousness. Please buy and try a box of C. C. C. to-day; 10, 25, 50 cents. Sold and guaranteed to cure by all druggists.

WANTED FOR THE UNITED STATES NAVY.

Qualified men for the ratings of ELECTRICIAN. Applicants must be capable of performing all duties pertaining to the care, preservation, and manipulation of a ship's electric lighting plant and its appurtenances, together with all other electrical appliances; they must also be physically qualified. First enlistment is made in the rating of Electrician, second class, (\$35 per month,) with possibility of future advancement to Electrician, first class, (\$40 per month,) and Chief Electrician, (\$50 per month). In addition to the pay stated, there is a ration allowance of 80 cents per day. Enlistments in this rating are made only at the Navy Yards, Brooklyn, N. Y.; Boston, Mass., and Mare Island, Cal.

INCORPORATIONS.

The Old Hickory Electric & Construction Company, St. Louis, Mo. Capital stock, \$50,000, of which one half is paid. Incorporators: Frank F. Sopp, Hiram Cole, J. C. Terry, F. M. Estes and J. H. Roberson.

The Biloxi Street Railway Company, Biloxi, Miss. Capital stock, \$7,500, with the privilege of increasing it not to exceed \$30,000.

The Chicago, Hammond & Western Railroad Company has certified to a consolidation of organization with the Chicago & Indiana Street Railway Company under the name of the Chicago Junction Railway Company. Capital stock, \$2,200,000.

The Maryland Traction Company, Baltimore—to own, maintain and operate any part or all of the railway property and franchises formerly owned and operated by the Columbia & Maryland Railway. Capital stock, \$700,000. Directors: Thomas J. Hayward, Henry A. Parr, Robert S. Carwell, William H. Boehler and Edward P. Hill, of Baltimore.

The Emmitsburg Railroad Company of Frederick County, Emmitsburg, Md. Capital stock, \$50,000. Directors: James A. Elder, John P. Branner, William A. Hines, William G. Blair, Vincent Sebold and James H. Muscan, of Wilmington, Del.

The Brownwood Ice & Light Company, Brownwood, Tex.—to supply light, electric motive power and to manufacture ice. Capital stock, \$30,000. Incorporators: Brooke Smith, John G. Lee and J. W. Shepard.

The Vicksburg Railroad, Power & Manufacturing Company, Vicksburg, Miss. Capital stock, \$250,000. Incorporators: Percival Steele, J. C. Shaffer, J. C. Roberts, R. L. Roberts, Thomas H. Owens, D. R. Lamont, Murray F. Smith and M. J. Mulvihill.

The Sturgis Motor Vehicle Company, Los Angeles, Cal.—to manufacture motors and control motor power. Capital stock, \$1,000,000, of which \$250,000 is subscribed. Directors: Alfred Solano, S. D. Sturgis, W. W. Sturgis, J. W. A. Off and Charles H. McFarland, all of Los Angeles.

The Magnetic Electric Light & Power Company has filed its charter in the Registrar's office at Memphis, Tenn. The capital stock is \$10,000,000, which is divided into 100,000 shares of \$100 each. The company will engage in the making and supplying of light and power by electricity produced by magnet. It will also do any and all business pertaining to electric light and power. Incorporators: M. E. Carter, F. W. Brode, B. M. Stratton, W. O. Bridges and H. F. Robinson.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED APRIL 26, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 602,923. Trolley. James E. Wells, Syracuse, N. Y. Filed May 1, 1897.
603,060. Electric Railway. Charles F. Holtmann and Charles Bergmann, Pittsburg, Pa. Filed Aug. 3, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 603,922. Electric Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed Nov. 4, 1897.
602,933. Electric Luminous Alphabet and Board for Same. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Dec. 17, 1895.
603,046. Incandescent Electric Lamp. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed July 22, 1891.
603,112. Electric Lamp. David Misell, New York City, assignor, by mesne assignments, to the American Electrical Novelty & Manufacturing Company of New York. Filed Oct. 9, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 602,895. Electrical Selector. Louis W. Crofoot and Frank E. Granger, Aberdeen, S. D. Filed Sept. 14, 1897.
602,920. 602,921. Alternating-Current Induction-Motor. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Feb. 12, 1897.
602,925. System of Electric Metering. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Dec. 31, 1897.
602,968. Distribution of Electric Currents. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed Dec. 6, 1896. Renewed Feb. 26, 1898.
603,027. Rheostat. Roscoe W. Ney, New Rochelle, N. Y., assignor to the Zucker & Levett & Loeb Company of New York. Filed Feb. 5, 1897.
603,041. Electrostatic Generating Machine. Adrian H. Hoyt, Penacook, N. H. Filed Aug. 9, 1897.
603,061. Device for Turning Off Commutators of Dynamos or Motors. William H. Jordan, Brooklyn, N. Y. Filed Jan. 28, 1897.
603,063. Rheostat. Harry W. Leonard, East Orange, N. J. Filed July 28, 1896.

MISCELLANEOUS.

- 602,872. Process of Producing Chemical Compounds by Electrolysis. Joseph W. Richards and Charles W. Roepner, Bethlehem, Pa. Filed July 6, 1897.
602,873. Process of Electrolytically Manufacturing Metallic Sulphide. Joseph W. Richards and Charles W. Roepner, Bethlehem, Pa. Filed July 6, 1897.
603,042. Hinge Connection for Electrical Measuring Instruments. Adrian H. Hoyt, Penacook, N. H. Filed Nov. 1, 1897.
603,058. Electrical Retort. Hillary Eldridge, Daniel J. Clark and Sylvain Blum, Galveston, Tex. Filed June 28, 1897.
603,060. Electric Cable. Nathaniel G. Warth, Indianapolis, Ind. Filed Oct. 25, 1897.
603,184. Electropneumatic Piano-Player. Fred R. Goolman, Los Angeles, Cal., assignor of three-fourths to John Weber and John N. Goolman, same place. Filed May 5, 1897.
603,198. Electrically-Propelled Vehicle. Henry G. Morris and Pedro G. Salom, Philadelphia, Pa. Filed Sept. 29, 1896.

TELEPHONE AND TELEGRAPH.

A telephone war is on in Monroe, La. The Cumberland Telephone & Telegraph Company have fired the first shot by making a tremendous cut in the rates of residence telephones and giving all ministers' phones free of charge. They have started a war of extermination with the Monroe Telephone Company as the enemy, and it promises to be a long and hard fought battle, as the directors of the home company have determined to make a valiant stand. When asked by a N. O. Picayune correspondent what position his company would take under the circumstances, President W. B. Reilly of the Monroe Telephone Company said: "Why the same stand we have now—good service and business methods. No, we won't pay any more attention to them than if they didn't exist. They can't take our customers from us and they are simply cutting their own throats. The main reason why such a reduction was made, I presume, was from the fact of our intention of declaring a 25 per cent. dividend to our stockholders. The dividend will be in the shape of a reduction in rates, and if we do as well next year as we have in the past we will further reduce the rate. We are here to stay and mean to give our customers the benefit of the best service in the country."

The New Orleans Times-Democrat of April 22 says: "W. L. Holmes, president of the Detroit Telephone Company, president of the Michigan New State Telephone Company and president of the Detroit Switchboard and Telephone Construction Company, left for his home in Detroit, Mich., last night, after having spent two days in this city conferring with the officers and promoters of the People's Telephone Company. Mr. Holmes, in the capacity of president of the Construction Company, is the man who will from this time back up the New Orleans scheme. President W. L. Curtis, of the People's Company, who has been looking over the situation with Mr. Holmes, said last night that there was an apparent disposition on the part of the public in New Orleans to want to wait and subscribe after the plant has been put into operation. This he considers an entirely wrong spirit, because the Detroit capitalists do not care to come here and invest until the subscriptions will warrant the venture. He says the People's Telephone Company in New Orleans is left entirely with the public. It is for them to say whether or not they will have the new service."

The telephone investigation going on in Washington has brought out some facts in regard to the local Bell company's affairs that are not calculated to render it less objectionable to its disgruntled patrons. In its comments on a hearing before the committee, the Star thus refers to some of the testimony given: "The most important disclosure of the morning session was the admission extracted from the expert that he had found items that should have been charged to the construction account tucked away in the maintenance account. It is notorious that the tendency of this company as of all semi-public corporations with large earnings is to swell to the largest possible point the total of the sums expended for maintaining the service, in order to reduce the ratio of apparent profits. All sums expended in construction are not properly to be thus accounted for, inasmuch as they represent permanent betterments, making for increased earnings in the future."

The city council of Chattanooga, Tenn., has two telephone franchises on its hands for consideration. J. A. Henlin, of New York, represents one of the companies asking for a franchise, and E. W. Coleman the other. The Chattanooga Times says: "There is little likelihood of the adoption of the ordinances in their present form, but a number of the aldermen charge that the telephone rates of the East Tennessee Telephone Company are too high, and it is within the bounds of possibility that one of the ordinances will be adopted in the near future, granting a new telephone franchise."

There seems to be little likelihood of any opposition to the Bell Company in Buffalo for some time, as the petitions of the Western New York Telephone Company and the Buffalo Telephone Company for franchises have been filed away in the slumbering boxes of the Aldermanic Committee, which, as one of the committee acknowledged, is equivalent to a denial. There will be an effort made before the Board of Aldermen on May 9 to have the petitions resuscitated.

The Syracuse Herald states that things are nearly in readiness for opening the Oneida Telephone Company's automatic exchange in Oneida, N. Y. The Oneida Company has had to encounter the hostility of the local Bell company, exerted in every possible way, but has succeeded in getting a footing and starts out with a fair list of subscribers.

The Automatic Telephone Service Company, which has applied for a franchise in Rochester, N. Y., was permitted

to use the council chamber to display its apparatus and show the actual operation of the system. The exhibition made a good impression upon the aldermen and officials and there is every probability that the franchise will be granted. The company promises to supply efficient service at about half the rates charged by the Bell Telephone Company.

At Shelbyville, Ind., a few days ago, the Bell Telephone Company gave notice that after May 1 there would be no rental charged for their telephones. At Wabash, the Bell Telephone Company has established free service between Goshen and Elkhart. The moves at both places are to head off new competing companies.

The stockholders of the Jacksonville (Fla.) Telephone Company, at a meeting on the 22d ult., elected the following officers and directors: President and general manager, W. N. Shine; vice-president, George P. Glenn; directors: W. N. Shine, George P. Glenn, John C. L'Engle, W. M. Bostwick, Jr., C. S. Adams and A. H. King.

The Bell telephone instrument statement for the month ended April 20 shows: Gross output, 29,754; returned, 13,139; net output, 16,125. In the same month in 1897 the gross output was 20,428; returned, 7,245; net output, 13,181. The total outstanding on April 20 last was 977,345; at the same date in 1897 the total outstanding was 819,428.

Durand, Mich., is to have a telephone exchange, the council having granted a franchise to a resident of the village for that purpose. The exchange will be in operation by August 1, and the rates will be \$20 per year for business houses and \$15 for residences.

The Bell Company and the American Long Distance Telephone Company are rapidly extending their lines throughout North Alabama. The latter company proposes to connect every town in that section of the State.

The Delaware County Telephone Company, Chester, Pa., proposes to increase its capital stock from \$25,000 to \$75,000, and has decided to extend its lines until the circuit includes all the boroughs and important towns in the county.

The Minnesota Central Telephone Company has accepted the ordinance granted by the city council of St. Paul, and has filed a \$5,000 bond with the city clerk.

The Home Telephone Company of Sioux City, Ia., is arranging to extend its lines from Merville to Pierson, Correctionville, Waukegan, Rock Branch, Lucky Valley, Anthon, Ote and Smithland.

The Nebraska Telephone Company will open an exchange in Schuyler, Neb. It is said that E. Long will have charge of the exchange.

The Columbia Telephone Company has been granted a franchise to erect its poles and wires and conduct telephone business in the borough of Mount Joy, Pa.

The New State Telephone Company will probably establish an exchange in Carson City, Mich.

New Companies Incorporated.

The Prineville Telephone Company, Prineville, Ore. Capital stock, \$500. Incorporators: T. M. Baldwin and William Wurzwiler.

The following charters have been filed with the Secretary of State at Jackson, Miss.: Vicksburg & Yazoo City Telephone Company; Vaiden Telephone Company, capital stock, \$1,000; Holmes County Telephone Company, Lexington, capital stock, \$500.

The Northwest Telegraph & Telephone Company, Huntington, Ore. Capital stock, \$3,000. Incorporators: J. H. Aitken, B. L. Stayner and J. Millis.

The Montour & Columbia Telephone Company, Bloomsburg, Pa.—to maintain and lease lines of telegraph and telephone. Incorporators: C. P. Hancock, J. H. McDewitt, F. C. Angle, E. C. Corman, W. W. Ryan, J. P. Helfenstein and H. E. Murry.

The Madison Telephone Company, Belleville, Ill. Capital stock, \$20,000. Incorporators: W. H. Johnson, B. L. Behr, E. W. Lazell and J. Wright.

The Telephone Receiver Company, Detroit, Mich. Capital stock, \$5,000.

The Waverly Telephone Company, Waverly, Ill. Capital stock, \$1,400. Incorporators: J. E. Hutchinson, L. D. Foreman and G. E. Pearl.

The Almyra Telephone Company, Almyra, N. C. Capital stock, \$5,000. Incorporators: Will A. Wynne, W. W. Wynne and N. E. Edgerton.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; extn., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of 1st Div.	Bid.	Asked.
		Authoriz'd	Issued.			
Albany, N. Y.—May 2:						
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1% Q., Feb. '98.	145	147½
Troy City Railway Co.....	100	2,000,000	2,000,000	1% Q., Dec. 10, '97.	68	69
Traction Co. (Saratoga).....	100	50,000	50,000	.....	..	..
Allentown, Pa.—May 2:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000	.....	..	15
Bridgeport, Conn.—May 2:						
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1% Aug., '97.	45	60
Baltimore, Md.—May 2:						
Baltimore City Passenger Ry. Co...	25	6,000,000	2,500,000	5% S., July 2, '97.	71	72
aBaltimore Consolidated Ry. Co....	25	10,000,000	9,177,000	2% S., Jan. 15, '98	22½	22¾
Central Ry. Co. of Baltimore City..	50	800,000	800,000	6% A. Dec., 1897.	80	82½
Boston, Mass.—May 2:						
New England Street Ry.....	25	5,000,000	1,081,925	1% Q., Jan. 15, '97.	10	..
North Shore Traction Co.....com.	100	4,000,000	4,000,000	.....	..	13
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000	6% S. A. & O.	67	72
b West End Street Ry. Co.....com.	50	10,000,000	9,085,000	1% S., Oct., '97.	82	82½
b West End Street Ry. Co... 8% pfd.	50	6,400,000	6,400,000	4% S., Oct. 1, '97.	102	102½
Boston Elevated R. R.....	100	10,000,000	..	.....	57	59
Brooklyn, N. Y.—May 2:						
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,400	2% Feb. 1, 1898.	185	195
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	.....	39½	89½
aBrooklyn Heights Railroad.....	..	200,000	200,000	.....	..	..
*dBrooklyn City RR.....guar.	100	12,000,000	12,000,000	2½% Q., Jan., '98.	198	260
aBrooklyn, Queens Co. & Sub. RR.	..	2,000,000	2,000,000	.....	..	..
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1½% Oct. 1, '97.	140	..
Kings County Elevated.....	..	4,750,000	4,750,000	.....	..	..
Kings County Traction Co.....	100	4,500,000	4,500,000	1% July 28, '97	45	48
Nassau Electric Railroad.....	..	6,000,000	6,000,000	.....	..	37½
aAtlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	..	..
aBrooklyn, B. & W. E. Railroad..	..	1,000,000	1,000,000	.....	74	80
Buffalo, N. Y.—May 2:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	.....	58	60
*Buffalo Railway Co.....	100	6,000,000	5,870,500	1% Q. Dec., '97.	76	80
Columbus O.—May 2:						
Columbus Street Railroad.....	100	8,000,000	8,000,000	1% Q., Feb., '98.	45	46
Columbus Central Street Railroad..	100	1,500,000	1,500,000	.....	..	..
Charleston, S. C.—May 2:						
Charleston City Ry. Co.....	50	100,000	100,000	3% S., Jan., '97.	..	..
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	..	..
Chicago, Ill.—May 2:						
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3% Q., Dec. 31, '97.	220	225
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800	.....	11½	12
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	..	8½
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	.....	..	..
Met. West Side El. const. etc.....	100	15,000,000	2,500,000	.....	..	..
North Chicago Street RR.....	100	15,000,000	6,600,000	3% Q., Jan., '98.	185	187
aNorth Chicago City RR.....	100	500,000	249,900	.....	..	..
South Chicago City Railway.....	100	2,000,000	1,603,200	.....	..	..
West Chicago St. RR. Co.....	100	20,000,000	13,189,000	1½% Q., Feb. '98.	87	88
Chicago West Div. Ry.....guar.	..	1,250,000	624,900	35% ..	..	..
Chicago Passenger Ry.....guar.	100	2,000,000	2,000,000	5% S. ....	..	..
Cincinnati, Ohio.—May 2:						
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000	.....	..	20
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000	2½%., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,800,000	.....	28	23
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1½% Q., Jan., '98.	112½	118
Mt. Adams & Eden Park Inc. Ry....	50	2,500,000	2,200,000	1½% Q., Jan., '98.	..	..
Cleveland, Ohio.—May 2:						
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..	..	..	..
Ar	..	..	..

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.			
Hartford Conn.—May 2:						
Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000	3 % S., Jan., '98.	140	--
Hartford & West Hartford RR.....	100	1,000,000	247,000	.....	--	--
Holyoke Mass.—May 2:						
Holyoke Street Ry. Co.....	100	400,000	400,000	4 % A., Jan., '98.	200	205
Hoboken, N. J.—May 2:						
North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind.—May 2						
*Citizens' Passenger Ry.....	...	5,000,000	5,000,000	.....	24	25
Lancaster, Pa.—May 2:						
Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	--	--
Lancaster & Col. Electric Ry.....	.....	.....	87,500	.....	--	--
West End Street Railway.....	.....	.....	.....	.....	--	--
Louisville, Ky.—May 2:						
Louisville Ry.....com.	100	4,000,000	3,500,000	1½ %, Oct., '97.	30	35
Louisville Ry.....5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	87	94
Minneapolis, Minn.—May 2:						
Twin City Rapid Transit.....com.	100	17,000,000	15,010,000	.....	14	20
Twin City Rapid Transit.....7 % pfd.	...	8,000,000	1,714,200	1½ % Jan., '98.	--	100
Montreal, Canada.—May 2						
Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8 % S., M. & N.	216	246½
Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1½ % S., J. & J.	90½	91½
Memphis, Tenn.—May 2:						
Memphis Street Railway Co.....	100	500,000	500,000	.....	15	--
New Haven, Conn.—May 2:						
Fair Haven & Westville RR.....	25	1,500,000	900,000	4 % S., Sept. '97.	60	...
New Haven Street Railway Co.....	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville.....	100	700,000	300,000	.....	--	--
Winchester Avenue RR.....	25	1,000,000	600,000	.....	40	42
New Orleans, La.—May 2						
Canal & Claiborne RR. Co.....	40	240,000	240,000	1 % S., Jan., '98.	140	160
New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	½ % Q., Jan., '98.	123½	126
New Orleans Traction Co.....com.	100	5,000,000	5,000,000	.....	2	8
New Orleans Traction Co.....pfd.	100	2,500,000	2,500,000	.....	8	10
aCrescent City RR.....guar.	100	2,000,000	2,000,000	8 % S., Jan., '98.	--	30
bNew Or. City & Lake RR.....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	88
cOrleans Railroad.....	50	500,000	185,000	½ %, June, '94.	16	17
St. Charles Street Railway.....	50	1,000,000	1,000,000	1½ % Jan., '98.	53½	54½
New York.—May 2.						
Central Crosstown RR.....	100	600,000	600,000	2½ % Q., July, '97.	50	...
cChristopher & 10th Sts. RR.guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	164
dDry Dock, E. B'way & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., '98.	175	195
eMetropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1½ % Q., Jan., '98.	143¼	145
fBleecker St. & Fulton Fy. Ry.guar	100	900,000	900,000	¼ % A., July, '97.	32	34
gBroadway & Seventh Ave.guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	205	215
hGen. Park. N. & E. Rivers RR.guar	100	1,800,000	1,800,000	2½ % Q., Jan., '98.	177	185
iElighth Avenue RR.....	100	1,000,000	1,000,000	.....	310	325
j42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q., Feb., '98.	380	360
kNinth Avenue RR.....guar.	100	800,000	800,000	.....	192	194
lSixth Avenue RR.....guar	100	2,000,000	2,000,000	.....	200	215
mTwenty-third St. R. R. Co.guar.	100	600,000	600,000	4½ % Q., Feb., '98.	810	825
nSecond Avenue RR.....	100	2,500,000	1,862,000	2 % Q., Jan., '98.	165	170
oThird Avenue RR.....	100	12,000,000	10,000,000	2 % Q., Feb., '98.	165	170
p42d St., Manhat'le & St. Nich. Av	100	2,500,000	2,500,000	.....	50	60
qUnion (Huckleberry) Ry.....	100	2,000,000	2,000,000	.....	175	200
Newark N. J.—May 2:						
Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000	.....	44	45
Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	--	--
nRapid Transit Street Ry.....	100	504,000	504,000	11¾ % A.	180	190
Pittsburg, Pa.—May 2:						
Allegheny Traction Co.....	50	500,000	500,000	.....	--	45
oConsolidated Traction Co.....com.	50	15,000,000	15,000,000	2 % Jan., '95.	127½	13½
pConsolidated Traction Co.....pfd.	50	15,000,000	15,000,000	3 % May, '97.	44¼	46½
qCentral Traction Co.....	50	1,500,000	1,900,000	.....	--	--
rCitizens' Traction Co.....	50	8,000,000	13,000,000	6 % A.	--	--
sDuquesne Traction Co.....	50	8,000,000	13,000,000	6 % A.	--	--
tPittsburg Traction Co.....	50	2,500,000	1,900,000	3 % Aug., '95.	--	--
uFederal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000	2½ % Jan., '98.	23	--
vPgh., Allegheny & Man. Trac. Co....	50	8,000,000	12,994,839	2 % Aug., '95.	--	--
wPittsburg & Birmingham Trac. Ry..	25	8,000,000	8,000,000	½ % Jan., '96.	18½	18½
xPittsburg & West End Ry.....	50	1,500,000	1,500,000	5 % A., June 30, '97.	--	--
ySecond Avenue Traction Co.....com.	50	4,000,000	14,000,000	.....	--	--
zSuburban Rapid Transit Co.....	50	800,000	200,000	.....	--	--

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Ottumwa Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 b Leased to Eastern Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h \$50 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$625,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

- * Unlisted. † Full paid. ‡ Outstanding. § Ex div.
- a Leased to New Orleans Traction Company at 6 % on stock.
- b Leased to New Orleans Traction Company at 8 % on stock.
- c Leased to Central Cross-town Railroad at 8 % on stock and interest on bonds.
- d Operating the former Met. Trac. system, that corporation having become extinct.
- e Leased to 28th Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
- f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
- g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
- h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
- i Leased to Metropolitan Street Railway for 18 % on stock.
- j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
- k Leased to Metropolitan Street Railway for \$145,000 per annum.
- l Leased to Metropolitan Street Railway for 18 percent. on capital stock.
- m Controlled by Third Avenue Railroad by purchase.
- n Dividends of 1½ % yearly guaranteed by Consolidated Traction Company.
- o Controls by lease the Alleg'y, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co
- p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
- q Leased to Fort Pitt Traction Company for 5 % on \$3,000,000 capital stock.
- r Leased to Consolidated Traction Company for 4 % on capital stock after October,
- s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.						Authoriz'd	Issued.			
New Bedford Mass.—May 2:							Boston, Mass.—May 2:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,550,000	4% Q. Jan., '98.	255	...
Northampton, Mass.—May 2:							Erle Telegraph & Telephone Co.....	100	.....	.....	1% Q. Jan. '98.	65	66
Northampton Street Ry.	100	800,000	225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	...	10,894,600	10,804,600	\$1.50 % Feb. '98.	125	128
Omaha, Neb.—May 2:							New York.—May 2:						
Omaha Street Ry.	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1% Q.	90	91
Paterson, N. J.—May 2:							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1% Q.	104	107
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	35	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q.	188	189
Providence, R. I.—May 2:							Franklin Tel. Co. 2% guar.	100	1,000,000	.....	1% S.	40	44
United Traction & Electric Co.	100	8,000,000	8,000,000	3/4 % Jan. '98.	59	62	Erle Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q. Jan., '98.	45	66
Philadelphia.—May 2:							*Gold & Stock Tel. Co. guar. 6 %	100	5,000,000	.....	1% Q.	109	114
Fairmount Park Trans. Co. ...\$20 pd.	50	2,000,000	1,770,000	2 % Dec. '97.	14 1/2	...	*International Ocean Tel. Co. guar. 6 %	100	8,000,000	.....	1% Q.	107	...
Hestonville, Man. & Fairmount.....	50	1,966,100	\$1,966,100	2 % Jan. 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	.....	.....	60	70
Hestonville, Man. & Fairmount.....	50	533,900	153,900	3 % S—Jan. 10, '98.	61	65	*New York & New Jersey Tel. Co....	100	5,000,000	8,723,000	1% Q. Jan., '98.	140	145
aFairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. Co. guar. 4 %	25	2,000,000	.....	2 % S.	72	78
Union Traction Co. ....\$12 1/2 pd.	50	30,000,000	29,330,450	.....	15 1/2	15 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 % Q.	87	90
eElectric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*South & Atlantic Tel. Co. guar. 5 %	25	950,000	559,525	2 % S.	111 1/2	118 1/2
dCitizens' Passenger Ry.....	50	500,000	112,500	\$3 share Q.	307	...	*Commercial Union Telegraph Co....	25	500,000	500,000	8 % S., Jan. 1 '98.	84 1/2	85
eFrankford & Southwark Pass. R.	50	1,000,000	1,187,500	\$14 share A—Apr. 97	372	...	Western Union Telegraph Co.....	...	97,870,000	.....	1 1/2 % Jan., '98.	...	...
fLehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	49	...	*Div. guar. by Postal Tel. Co.	...	.....	.....	...	...	...
fLombard & South Street Ry....	25	1,000,000	1,000,000	A. & O.	90 1/2	...	Miscellaneous.—May 2:						
dSecond & Third Streets Ry....	50	1,000,000	771,076	\$9 share A. Mar. 97	265	...	American Dist. Tel. (Phila.).....	25	400,000	.....	1 % Q., Feb. '98.	14	...
ePeople's Traction Co.....	50	10,000,000	16,000,000	3 % A., April, '97.	134	135	Bell Teleph. Co. (of Canada.).....	100	8,168,000	8,168,000	2 % S.	170 1/2	173
eGermantown Passenger Ry....	50	1,500,000	572,800	\$5 25 share—1898.	132	...	Chesapeake & Potomac Tel. Co....	100	.....	.....	.....	50	55
eGreen & Coates Passenger Ry....	25	1,500,000	150,000	3 % Jan., 1898.	132	...	Chicago Telephone Co.....	100	.....	.....	.....	202	...
ePeople's Passenger Ry.....com.	25	1,500,000	174,000	.....	...	...	Central Dist. Prtg. & Tel. Co. (Pgh.)	100	750,000	750,000	.....	68	76
ePeople's Passenger Ry.....pfd.	50	750,000	127,402	.....	80	80 1/2	Empire & Bay States Telegraph Co..	100	2,000,000	2,000,000	1 % Q.	70	75
iPhiladelphia Traction Co.....	50	30,000,000	120,000,000	4 % S—Oct. 1, '97.	...	...	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2 % Q.	87 1/2	...
iCatherine & Bainbridge St.....	50	1,000,000	400,000	6 % A—Mar., '97.	140	...	Providence (R. I.) Tel. Co.....	50	8,000,000	.....	.....	120	122
iContinental Pass. Ry. guar.	50	1,000,000	150,000	\$6 share—July, '97.	140	...	Southern New Eng. Tel. Co.....	100	8,000,000	.....	.....	...	...
iEmpire Passenger Ry. Co.....	50	1,000,000	147,500	\$7.50 share July '97	176 1/2	180	Boston, Mass.—May 2:						
iPhiladelphia City Pass. Ry....	50	1,000,000	298,650	\$3.50 share July '97	86	300	Fort Wayne Electric Co.....	...	.....	.....	.....	...	...
iPhiladelphia & Gray's Fy. RR....	50	1,000,000	142,000	\$12 share July '97.	...	...	Ft. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	...	...
iRidge Avenue Passenger Ry....	50	750,000	120,000	\$2 share July, '97.	...	...	General Electric Co. com.	100	40,000,000	30,460,000	2 % Q., Aug. 1898.	84	84 1/2
iPhiladelphia & Darby Ry. guar.	50	.....	125,000	1 1/2 % S., July, '97.	157 1/2	...	General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	85	90
i17th & 19th Sts. Pass. Ry.	50	1,000,000	135,000	\$11 sh. A., July, '97	275	228	T. H. Elec. Co. T. Secur. Series D.	...	.....	.....	.....	8 1/2	8 1/2
iThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	190,000	\$9.50 sh. A., July '97	227	228	Westinghouse Elec. & Mfg. Co. com.	50	.....	148,700	.....	20	21
iUnion Passenger Ry. Co.....	50	1,500,000	175,000	\$10 share, July '97	225	235	Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,998,053	1 1/2 % Q., Feb., '98.	61	52
iWest Philadelphia Pass. Ry....	50	750,000	.....	.....	...	...	Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,198,128	.....	...	...
Rochester, N. Y.—May 2:							New York.—May 2:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,938,000	.....	118	...
Reading, Pa.—May 2:							*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2 % Oct., '97.	108	104
iReading Traction Co.....	...	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	...	Edison Ore Milling Co.....	100	.....	.....	.....	10	18
iCity Passenger Ry.....	50	850,000	350,000	Jan., '98.	112	...	Edison Electric Storage Co.....	100	.....	.....	.....	...	...
iEast Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	...	General Electric Co. com.	100	40,000,000	30,460,000	2 % Q., Aug. 1898.	84	84 1/2
St. Louis Mo.—May 2:							General Electric Co. pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	85	90
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	...	...	Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	...
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec., 1898.	...	...	United Elec. Lt. & Pow. Co. pfd.	...	.....	.....	.....	...	...
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 % Jan. '98.	120	122	Pittsburg, Pa.—May 2:						
National Railway Co.....	...	2,500,000	2,479,000	1 1/2 % Jan., '98.	...	...	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	...
Cass Avenue & Fair Grounds....	100	2,500,000	2,500,000	.....	90	110	East End Electric Light Co.....	50	800,000	800,000	.....	...	10
Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct., '93.	95	105	Philadelphia, Pa.—May 2:						
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 % Jan., '98.	170	172 1/2	Edison Electric Light Co.....	100	2,000,000	.....	144 1/2	...	...
Missouri RR.....	50	2,400,000	2,300,000	1 1/2 % Jan., '98.	50	52 1/2	*Electric Storage Battery Co. com.	100	8,500,000	.....	19 1/2	21	...
People's RR. Co.....	50	1,000,000	300,000	50c., Dec., '89.	50	52 1/2	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	21 1/2	28 1/2	...
Southern Electric Ry.....com.	100	1,000,000	1,000,000	1 1/2 % Jan., '98.	100	102 1/2	*Penna. Ht. Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	...	...
Southern Electric Ry..... 6 % pref.	100	1,000,000	2,500,000	.....	56	57	*Penna. Ht. Lt. & Pow. Co. pfd.	50	5,000,000	.....	6 % Oct., '97.	...	...
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	3 % A., July, '95.	175	...	Northern Elec. Light & Power Co..	10	6,540,000	550,000	\$32500 dis. Jan. 11 '97	18 1/2	14
Union Depot RR.....	100	4,000,000	4,000,000	3 % A., July, '95.	...	...	Southern Elec. Light & Power Co..	10	187,500	187,500	.....	10	...
San Francisco, Cal.—Apr.							Miscellaneous.—May 2:						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	...	110	Brush Electric Co.....	50	.....	.....	.....	...	...
Geary Street Park & Ocean RR....	100	1,000,000	375,000	\$2.50 share, '96.	40	50	Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	87 1/2	40	...
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	53	Edison Illg. Co. (St. Louis).....	...	.....	.....	...	...	...
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	...	8 1/2	Eddy Electric Mfg. Co.....	25	.....	.....	...	15	...
Scranton, Pa.—May 2:							Hartford (Conn.) Elec. Light Co....	100	850,000	.....	125	128	...
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12	Hartford (Conn.) Lt. & Power Co....	25	175,000	.....	6	11	...
mScranton & Carbondale Trac. Co..	100	500,000	500,000	.....	...	18	New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	159	...	...
mScranton & Pittston Traction Co..	100	1,050,000	1,050,000	.....	...	...	Narragansett (Prov., R.I.) Elec. Co..	50	1,200,000	.....	2 % Q., Oct., '98.	83 1/2	85
Springfield Ill.—May 2:							Rhode Island Elec. Protec. Co.....	100	.....	.....	110	120	...
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11	Royal Elec. Co. (Montreal).....	...	1,000,000	.....	2 % Q.	146	150
Springfield O.—May 2:							Toronto (Canada) Elec. Light Co....	100	1,085,000	1,085,000	1 1/2 % Q.	132 1/2	132 1/2
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2	Thomson-Houston Welding Co.....	100	.....	.....	8 % S., Dec. 1, '98.	...	...
Springfield, Mass.—May 2:							Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	160	110
Springfield Street Ry.....	100	1,200,000	1,166,700	8 % A.	205	210	ALLIED INDUSTRIES.						
Toronto Canada.—May 2:							Boston Mass.—May 2:						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	90 1/2	91 1/2	American Electric Heating Co.....	50	10,000,000	.....	.....	06	07
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	246	246 1/2	Street Ry. & Ill'g Properties... pfd.	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '98	...	...
Washington, D. C.—May 2:							United Electric Securities Co... pfd.	100	.....	.....	3 1/2 % Feb., '98.	80	85
Belt Ry. Co.....	50	500,000	500,000	.....	...	...	New York.—May 2:						
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	72 1/2	72 1/2	Consolidated Electric Storage Co..	...	.....	.....	.....	18	20
Columbia Ry. Co.....	50	400,000	400,000	6 % A.	70	76	Edison European.....	...	.....	.....	...	1	8
Eckington & Soldiers' Home Ry....	50	707,000	652,000	.....	...	...	Safety Car Heating & Lighting Co..	100	.....	.....	.....	90	95
Georgetown & Tenallytown Ry....	50	200,000	200,000	.....	...	...	Worthington Pump Co.....com.	100	5,500,000	5,500,000	.....	20	25
Metropolitan Rtt. Co.....	50	1,000,000	453,900	2 1/2 % Q.	116	119	Worthington Pump Co.....pfd.	100	2,000,000	2,000,000	7 %	82	85
Worcester, Mass.—May 2:							Philadelphia, Pa.—May 2:						
*Worcester Traction Co.....com.	100	8,000,000	8,000,000	.....	15	17	Acetylene L. H. & P. Co.....\$35 pd.	50	1,000,000	.....	.....	...	...
*Worcester Traction Co..... 6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	92	94	Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	74 1/2	...
Worcester & Suburban Street Ry...	100	550,000	542,500	4 1/2 %, 1897.	84	...	United Gas Improvement Co.....scrip.	50	10,000,000	.....	.....	...	...

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.		Amount.		Due	Interest periods.	Bid.	Asked.	NAME.		Amount.		Due	Interest periods.	Bid.	Asked.
		Authorized.	Issued.							Authorized.	Issued.				
Albany, N. Y.								New Orleans La.							
Date of Quotation—May 2, 1898.								Date of Quotation—Apr. 25, 1898.							
The Albany Ry. 1st mtg. 5s.	.....		\$29,000	1905	.....	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000		427,500	1930	J. & J.	*111	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000		875,000	1947	M. & N.	*111	.....	Crescent City RR. Cons. mtg. g. 5s.	5,000,000	8,000,000	1943	J. & J.	75 1/2	77	
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000		850,000	1919	M. & N.	*117 1/2	.....	New Orleans City RR. 1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	111	
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000		150,000	1919	M. & N.	*115	.....	N. Ori's City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98 1/2	99 1/2	
Troy City Railway Co. 1st 5s	.....		.....	.....	.....	*105	105 1/2	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	850,000	1907	F. & A.	110	.....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.								Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	95 1/2	100	.....
								St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....	.....
								*\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$890,000 outstanding.							
Baltimore Md.								New York.							
Date of Quotation—May 2, 1898.								Date of Quotation—May 2, 1898.							
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	.....	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87	
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	.....	Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	108	
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102 1/2	103	.....	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	*105	109	
Bal. Trac. Co. No. Balto. div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	114 1/2	115	.....	Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120	
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	1960	J. & J.	101 1/2	.....	.....	Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	107 1/2	
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103 1/2	.....	.....	Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*111	112	
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....	.....	Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*115	117	
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	113	116	.....	Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	*107	106	
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113 1/2	114 1/2	.....	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115	
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....	.....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	113	116	
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119 1/2	.....	Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	84	87	
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. †\$151,000 in escrow to retire 1st mtg. bds.								Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	91	98	
								Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108	.....
								Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90	.....
								Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	92 1/2	94	.....
								Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	103	107	.....
								Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	113	.....
								Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122	.....
								Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	103	105	.....
								D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	930,000	1902	J. & D.	114	115 1/2	.....
								Dry Dock, E. Bd'y & Bat'y R. scrip 5 1/2 %	1,100,000	1,100,000	1914	F. & A.	100	*103	.....
								Elighth Av. RR. Co. Cert. indebt. 6 %	1,000,000	1,000,000	1914	F. & A.	103	.....	.....
								42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115 1/2	116	.....
								42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	F. & J.	85	90	.....
								Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	116	117	.....
								Metropolitan St Ry Co. g. m. cl. tr. g. 5s	12,500,000	1,500,000	1907	F. & A.	109 1/2	.....	.....
								Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110 1/2	.....
								Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	106	.....	.....
								Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117	.....
								South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	106	111	.....
								Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	117	120	.....
								Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....	.....
								Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108	.....
								Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111 1/2	114	.....
								Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....	.....
								†\$1,035,000 in escrow to retire gen. mtg. bonds. †\$4,850,000 in escrow to retire maturing obligations. †\$552,000 in escrow to retire 1st and 2d mtg. bonds. †In treasury, \$80,000. †Guar. by Union Ry. Co.							
								Toronto Canada.							
								Date of Quotation—May 2, 1898.							
								Montreal St. Ry. 1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	.....	.....	.....
								Toronto St. Ry. 1st mtg. g. 4 1/2 s.	4,550,000	2,200,000	1921	M. & S.	.....	.....	.....
								†\$35,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.							
								Philadelphia.							
								Date of Quotation—May 2, 1898.							
								Continental Pass. Ry. 1st mtg. 6s	350,000	310,000	1909	J. & J.	.....	.....	.....
								Empire Pass. Ry. 1st mtg. 7s	300,000	200,000	1900	J. & J.	.....	.....	.....
								Greene & Coates St. Ry. 1st mtg. 6s	100,000	100,000	1898	J. & J.	.....	.....	.....
								Lombard & So. St. Pass. Ry. 1st mtg. 6s	150,000	.....	1901	.....	.....	.....	.....
								People's Pass. Ry. 1st mtg. 6s	250,000	250,000	1905	J. & J.	.....	.....	.....
								People's Pass. Ry. 2d mtg. 5s	500,000	458,000	1911	J. & J.	.....	.....	.....
								People's Pass. Ry. Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	.....	.....	.....
								People's Pass. Ry. Stk. trs. cert. g. 4s	5,698,210	.....	1943	.....	101 1/2	101 1/2	.....
								Phila. City Passenger Ry. 1st mtg. 5s	200,000	200,000	1910	J. & J.	.....	.....	.....
								Philadelphia Trac. Co. Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A.	104	105	.....
								Thirteenth & 15th St. Ry. 1st mtg. 7s	100,000	100,000	1903	A. & O.	.....	.....	.....
								Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....	.....
								Union Traction Co. Coll. tr. 4s.	29,735,000	29,724,875	1945	A. & O.	.....	.....	.....
								West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....	.....
								West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115 1/2	.....	.....
								West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114 1/2	115	.....
								†The trust certificates were issued to pay for the shares of the Electric and People's Traction Lines purchased.							
								Pittsburg, Pa.							
								Date of Quotation—May 2, 1898.							
								Birmingham, Knox & Allentown. 6s.	500,000	500,000	1931	M. & S.	.....	90	.....
								Central Traction Co. 1st mtg. 5s.	375,000	375,000	1930	J. & J.	.....	.....	.....
								Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....	.....
								*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	.....	169	.....
								*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1913	J. & J.	.....	.....	.....
								Fed'l St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	.....	.....	.....
								Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1923	M. & N.	.....	.....	.....
								Pittsburg, Crafon & Mansfield. 5s.	250,000	250,000	1924	J. & J.	.....	.....	.....
								Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	.....	.....
								Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	104	.....	.....
								Pittsburg & West End. 1st mtg. 5s.	500,000	500,000	1922	J. & J.	.....	.....	.....
								*Pg'h. Allegh. & Manch. Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	.....	.....	.....
								Second Ave. Traction Co. 5s.	2,500,000	2,000,000	1934	J. & D.	.....	.....	.....
								Sub. Rapid Transit Railway Co. 6s.	500,000	500,000	1913	M. & S.	.....	.....	.....
								Providence R. I.							
								Date of Quotation—May 2, 1898.							
								Newport Street Ry. Coupon 5s	50,000	50,000	1910	J. & D.	.....	.....	.....
								United Trac. & Elec. Co. 1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	.....	107
								St. Louis.							
								Date of Quotation—May 2, 1898.							
								*Baden & St. Louis RR. 1st mtg. 5s.	250,000	250,000	1913	J. & J.	100	102	.....
								Cass Ave. & Fair Gds. Ry. 1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102 1/2	103 1/2	.....
								Citizens' Railway Co. 1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107 1/2	108 1/2	.....
								*C omp. Hts., Un. De. & Mer. Ter. 1st 6s	1,000,000	1,000,000	1913	J. & J.	110 1/2	112 1/2	.....

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—May 2, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	107
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	102
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101	102½
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry.....1st mtg. g. 5s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	111½	112½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Apr., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	127	129½
†Metropolitan Ry. Co.....1st mtg. 6s.	200,000	200,000	.....	.....	.....	.....
†Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	108½	110
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—May 2, 1898.						
Belt Ry. Co. ....U. S. mtg 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry. ....mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home. ....mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—May 2, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
†Citizens' St. R. (Ind'polis) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	108	109
†Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	97	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	18,965,000	1933	J. & D.	100½	101
†Crosst'n St. Ry. (Col'u's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1930	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,331,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) .....Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'vd to redeem prior liens.						
†\$620,000 in escrow.						

*With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—May 2, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000			Quar.	154	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	100½	.....
Pittsburg, Pa.						
Date of Quotation—May 2, 1898						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 4s.	250,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(May 2, 1898)						
Edison El. Illg. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1916	.....	109	.....
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,156,000	1930	.....	114½	.....
Edison Elec. Illg. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia).....	2,000,000	.....	.....	.....	103	.....
Edison Illg. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'try.	.....	.....
United Elec. Light & Power Co. (N. Y.).....	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—May 2, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 1st mtg. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 1st mtg. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—May 2, 1898						
American Electric Heating.....5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 5s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 1st mtg. 7s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 1st mtg. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 1st mtg. 5s.	71,000	.....	.....	.....	.....	.....
Quoted						
Nominal						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 12½c.; casting, 11½c.

The West Chicago Street Railway Company has declared a quarterly dividend of 1½ per cent., payable May 16.

The New Orleans Traction Company provided no funds to meet the coupons due May 1 on the \$1,500,000 of collateral trust notes.

The American District Telegraph Company of Philadelphia announces a quarterly dividend of 1 per cent., payable May 14.

The Bell Telephone Company of Philadelphia will meet on June 22 to vote on the question of increasing the capitalization from \$2,000,000 to \$4,000,000.

The Massachusetts Senate has definitely rejected the bill permitting cities and towns to own and operate electric lighting plants for public buildings and parks.

After a hearing on the 28th ult., in the suit of Patrick H. Flynn as a stockholder of the Coney Island & Brooklyn Railroad Company to enjoin the making of a \$1,500,000 mortgage, Justice Johnson reserved his decision.

The fact that stock quotations are seldom based on intrinsic values was never more plainly evident than in the upward jump of several points in the list on Tuesday on the announcement of Dewey's victory at Manila.

The Boston Gas & Electric Light Commissioners have approved an issue of \$110,000 stock and \$175,000 bonds by the Woburn Light, Heat & Power Company; \$85,000 of the bond issue will be used to take up outstanding bonds, the balance of the issue to be used for new construction and equipment.

The Massachusetts Railroad Commissioners have approved the issue of capital stock amounting to \$80,000, and first mortgage bonds to the same amount, by the Norton & Taunton Street Railway Company, the proceeds to be devoted to building the road and the establishment of an electric power plant.

The Philadelphia "Times" of April 27 says: "Frankford & Southwark Passenger Railway stock—par \$50—sold yesterday at \$400, the highest recorded price. The stock now pays \$14 a year. Beginning July 1 next the rate will be \$14.50. After that the amount will increase one dollar each year until it has reached \$18 in 1903, at which it will remain.

A syndicate headed by A. G. Danforth & Sons of Peoria, Ill., it is stated has secured control of the Decatur gas plant, including all the property, franchises and plant of the Decatur Light, Heat & Power Company, and also the Decatur Electric Company. The deeds were made out to Paul M. Bussy of Washington, Ill., who will hold the property in trust until the purchase is completed.

A notice of a mortgage by the Central Union Telephone Company to the Illinois Trust & Savings Bank Company was filed in the Recorder's office at Cleveland, O., on the 28th ult. The mortgage is to cover an issue of bonds aggregating \$1,600,000, on a permitted issue of \$3,000,000. As the company is believed to have no property in Cuyahoga County some surprise was expressed that the paper was filed in Cleveland.

A mortgage securing an authorized issue of \$1,000,000 of bonds against the property of the Cicero & Harlem Street Railroad (Chicago) will run to the Equitable Trust Company of Chicago as trustee. The bonds will bear 5 per cent. interest, running from April 1, 1898. The interest payments will be made semi-annually, on April 1 and October 1. The bonds will mature in forty years.

Directors W. W. Kurtz, William Jay Turner and R. H. Rushton of the Citizens' Street Railway Company of Indianapolis say: "Referring to circular issued by Alfred C. Harrison and others, under date of April 19, 1898, respecting election of directors of the Citizens' Street Railway Company of Indianapolis, we desire to state that our names have been used in said circular without our knowledge or consent. Further, we beg to say that we are not candidates for election as directors of said company, nor shall we serve if elected."

The directors of the Erie Telegraph & Telephone Company at their meeting at Boston on Friday last declared dividend No. 58 of 1 per cent., payable May 16 to stock of record May 7. The stock books will be closed at noon May 7 and opened on Monday, May 16. On account of advancing years Mr. Levi Sprague resigned as president of the company. Mr. Charles J. Glidden, vice-president, was elected president. Mr. Sprague will continue as a member of the board of directors.

A Boston syndicate, of which Messrs. Tucker, Anthony & Co. are the leading spirits, has purchased the Manchester (N. H.) Street Railway, which is capitalized for \$170,000 stock and \$250,000 bonds. Messrs. Tucker, Anthony & Co. also own the Manchester Electric Company, which does a gross business of \$125,000 a year and furnishes electric power to the street railway company. Mr. Saltonstall is president of the electric company and W. A. Tucker treasurer. It is not proposed to consolidate the companies.

The Fort Wayne & Belle Isle Railway Company of Detroit, having been succeeded by the Detroit, Fort Wayne & Belle Isle Railway Company, the new corporation has filed a mortgage for \$1,200,000 to secure 5 per cent. gold bonds due in April, 1927. The new loan will be used in part to refund the \$345,000 of old first mortgage bonds, which have been subject to call at par since October 1, 1897, and in part to meet the cost to the present owners of acquiring the property.

In a recent inquiry into affairs of the Terre Haute Street Railway & Electric Light Company, it was stated that \$500,000 or \$600,000 worth of bonds had been sold, increasing the debt by that amount, but of which there was no entry in the cash books. A committee was appointed, of which Edward Brown of the First National Bank of Chicago is chairman, to proceed with the investigation.

The Brooklyn Heights Railroad Company (Brooklyn, N. Y.) has made a contract with the Brighton Beach Racing Association, under which a complete change will be made in the operation and equipment of the Sea View Elevated Railroad Company. The scheme of the Heights Company to operate the Sea View road as an independent elevated system will be abandoned and the road will be run by electricity. An incline plane will be built east of the Boulevard on property controlled by the Racing Association, and on this portion the trolley cars will run on grade to the terminal at Brighton Beach. The change will be made by June 15. It is intended ultimately to put the entire Sea View road on grade. The Heights Co. contemplates extensive improvements on its Sea Beach route. The Coney Island terminal is in the Sea Beach Palace and a system of loops will be introduced.

A new traction consolidation which includes all the West End lines at Pittsburg, Pa., has been effected, as we learn from the Allegheny "Record." The new company will bear the name of the West End Traction Company and will include the Pittsburg & West End Passenger Railway, capital \$1,500,000 and \$450,000 bonds, with 16 miles of track; Pittsburg, Crafton & Mansfield Passenger Railway Company, capital \$500,000 and \$250,000 bonds; Pittsburg, Neville & Corapolis Passenger Railway Company, capital \$100,000 and \$100,000 bonds; Carnegie & Heidelberg Passenger Railway Company and the Pittsburg & Mt. Washington Railway Company. Improvements costing about \$250,000 will be started at once to extend the lines, bring the system to perfection, to secure better service and make the operation more economical. The capital stock of the new company will be \$5,000,000, half of common and half of preferred stock. The officers are: President, John C. Reilly; secretary, W. V. Callery; treasurer, William J. Burns; directors: James D. Callery, W. V. Callery, Thomas S. Bigelow, John C. Reilly and William J. Burns.

ELECTRICITY.

Vol. XIV.

NEW YORK, MAY 11, 1898.

No. 18.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	273-274
General Opinion Regarding Sixth Annual Report.	
Garbage Destructors.	
The Northwestern Convention.	
Another Patent Decision Against the General Electric Company.	
Under the Searchlight,	274
First Week of the Electrical Exhibition,	275
Garbage Destructors. By A. E. Brooke Ridley,	277
Some Recent Improvements in Accumulators and their Application to Traction on Common Roads. By J. T. Niblett. (Concluded),	278
System for Protection of Railway Trains. By Emile Diendonne. (Translation),	280
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XIX—Bullion Refining. By J. B. C. Kershaw, F. I. C.,	280
Annual Meeting of the General Electric Company,	281
Legal Notes,	282
The New York Electrical Society,	282
The News,	282
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—War Work of the Electricians,	
Recent Company Elections,	283
Commercial Paragraphs,	283
Incorporations,	284
Electrical Patent Record,	284
Telephone and Telegraph,	284
Electrical Securities—Stocks, Bonds, Etc.,	285
Notes for Investors,	288

EDITORIAL NOTES.

General Opinion Regarding Sixth Annual Report.

The Sixth Annual Report of the General Electric Company, which appeared last week, is generally looked upon as a great disappointment. The glowing newspaper reports which this company has constantly had published, tending to show its prosperity, and leading the stockholders to believe that an early settlement of back dividends would shortly be effected, has made the truth as set forth in its last annual report all the harder for the keyed-up stockholders to bear. Even the papers that have all along supported the General Electric Company in its, to say the least peculiar, policy are beginning to get their eyes open and are apparently gradually coming to look at the affairs of the company from the standpoint of **ELECTRICITY**. Referring to the Sixth Annual Report, our contemporary the *Electrical Engineer* says:

"We print elsewhere a full abstract of the General Electric Company's report covering the year 1897. The striking feature of this report as compared with that of the previous year is the fact that the gross earnings were less by nearly \$300,000 than those of the year previous, while the expenses were increased by more than \$500,000. This showing is strong evidence of the fact that while the company may have been comparatively busy, the prices obtained must have been low."

For once we heartily agree with our contemporary. There is not the slightest doubt but what the prices obtained must have been low, very low indeed—in fact in some cases amounting almost to a minus quantity. This we have claimed all along. Why attempt to make a fair profit on electrical apparatus when a much greater return can more easily be made by the manufacture of stock!

With a view of giving our readers an idea of what some of the financial papers think of the General Electric Company's Sixth Annual Report, we publish the following from the *Boston News Bureau*, which is usually very friendly to the Schenectady concern:

"The annual report of the General Electric Company is a disappointment as showing a gross business of only \$12,500,000 for the largest electric machinery concern in the world. We figure that if the prices for electrical apparatus that were obtained as late as 1892, or the year following the consolidation and the formation of the present company, had prevailed last year, the gross business would have exceeded \$50,000,000.

"But a beggarly million a month for a \$50,000,000 concern, doing business all over the world, and spending \$100,000 a year for stenography and type-

writing alone, gives a shareholder the consolation only of certainty that the business of the General Electric Company is on bottom at last.

"It was figured when the consolidation was made that net earnings of \$5,500,000 were in sight for the General Electric Company, and that with control, through the patent situation, of the electric apparatus of the United States there would come the control in financing of all street railways, electric lighting and power plants in the country, and that the business of the General Electric Company would in a few years be measured by hundreds of millions and ultimately pass that of the Standard Oil.

"But the financial winds beat upon that ship and top sails were quickly blown away or folded in, while during the 1893 gale anchors, cables and sheets valued at \$12,000,000 were thrown overboard for \$4,000,000 in cash."

But what has occurred since? The *Bureau* says:

"The ship was saved by almost superhuman work and everything is now in good financial trim, but there is no longer thought of rivaling the great industrial concerns of the world, or even of controlling the electric field."

The methods then adopted by the General Electric Company were intended to destroy the prospects of the limited legitimate business that was being done in the electrical industry by underselling all the independent companies, if necessary at a loss, and thus if possible run them out of business, with a view to making a good showing in gross earnings. It has been, however, impossible to carry on a business at a loss, even in conjunction with the manufacture of stocks and bonds, and the true condition of affairs is now apparent. Notwithstanding the aid of manipulators in stocks, and the reckless efforts of importunate agents, the concern has been unable to pay any dividends, and is now in travail on the question of reducing its capital and reorganizing its whole financial system.

Elsewhere in this issue will be found an accurate account of the annual meeting of the stockholders of the General Electric Company, held in Schenectady on the 10th inst. As we all along predicted, nothing of any importance was accomplished, if we except a resolution which was passed to the effect that the interests of the company demanded an adjustment of the impairment of its capital, which means little or nothing. Probably the most important feature of the meeting was the acknowledgment by Mr. Coffin that the value of the patents and franchises, which is placed at \$8,000,000, was excessive and should be revised.

It would seem very much to us as if the "ship" the *Bureau* refers to was now scudding under bare poles in a gale of wind with a high sea running, all conditions pointing to disaster unless some way can be devised for marooning the captain.

Garbage Destructors. In an editorial which appeared in our issue of December 22, 1897, we described in a general way a number of garbage destructor plants now in operation in England. We were indebted for most of the information published at that time to Mr. A. E. Brooke Ridley of San Francisco, a practicing engineer, who had just returned from abroad after having made a careful examination of a large number of these plants. At that time we promised our readers a more detailed description of the leading destructor plants in Great Britain at no distant date. In this issue, therefore, appears an illustrated article by Mr. A. E. Brooke Ridley describing the three leading destructor plants in England, namely that of Shoreditch, Ealing and Oldham. The plant at Shoreditch, which has attracted considerable attention in this country owing to the fact of its being situated in a vestry of London, is run on quite an elaborate and extensive scale, the steam produced by the use of the refuse fuel being utilized to generate electricity for lighting purposes by the aid of what is known as the Halpin thermal storage system, which, as we described in our issue of August 25, consists of large iron cylinders in which water under pressure is heated to a high temperature with a view to storing surplus energy or heat when the load is light to be drawn on during the busy hours.

From Mr. Ridley's article it will be seen that the destructor plants now scattered throughout Great Britain may be divided into three general systems as illustrated by that of Shoreditch, Ealing and Oldham. Several refuse destructors, and among others that of Oldham, have been designed with a view to cremating dead animals that may be found in the streets. In this plant eight tons of town refuse is destroyed per cell every twenty-four hours, generating a heat of approximately 1,400° Fahrenheit.

In the United States a complete investigation would be necessary, according to Mr. Ridley, to ascertain what saving a city would effect by installing a plant of this character. In most of the destructors in England the steam produced by the low grade fuel of a community can be made to generate sufficient electric power to run all the arc lights necessary for illuminating the streets of that community. The labor cost of plants in various towns in England with which Mr. Ridley ends his article should be found extremely interesting, although these figures can scarcely be looked upon as a criterion or of especial value in determining the cost of running a plant in this country, owing to the difference in price of labor in the two countries.

The satisfactory and more or less remunerative method of disposing of garbage now in vogue in a number of cities of Great Britain should prove interesting to the New York authorities now that the question of garbage disposal has come up again, and at a time when there is some suggestion of returning to the primitive methods in use some four years ago, that of dumping the city refuse on Riker's Island to ultimately decompose and become a public nuisance by giving off foul odors. It might pay New York City to carefully examine into the destructor question before again deciding to use Riker's Island as a dumping ground.

* * *

The Northwestern Convention.

As the time draws near for the holding of the summer meeting of the Northwestern Electrical Association, no pains are being spared by the committee having in charge the arrangements to make the gathering a most pleasant and profitable one. Mr. J. M. Hill, chairman of the committee having in charge the summer meeting of the Association, and Mr. Thomas R. Mercein are at present in this city extending invitations to a number of honorary guests in behalf of the cities of Duluth and Superior, in which two cities the Convention is to be held jointly.

Mr. Thomas A. Edison, Professor Thomson, Mr. Frank Sprague, Mr. Nikola Tesla and Mr. Wood of the Fort Wayne Electric Corporation have been especially invited. The three first have already accepted, and while Mr. Tesla and Mr. Wood have the matter still under consideration, it is thought that they will ultimately consent to be present.

As we have already explained, some time ago, a Convention lasting three days will be held on board the spacious and commodious steamer Northwest. The party, including a large number of well known electrical engineers and a number of ladies, will leave Chicago on June 10, calling at Milwaukee for the Wisconsin delegates. The steamer will then proceed to Duluth, stopping on the way at Mackinac Island, Sault Ste. Marie, Hancock and Houghton. Those present at the Convention will have an opportunity of visiting the well known Calumet and Hecla copper mines while the ladies of the party are being entertained by the ladies of Hancock and Houghton.

A unique feature of the Convention on the steamer will be the establishment of a question box in which questions will be dropped and answered by experts during the session. Various topics of importance will be discussed, including arc lamps, lighting, meters, transformers, measuring instruments, boiler furnaces, boilers, engines and mechanical draught—in short almost every topic of interest to the electrical engineer, central station man and manufacturer. Noted experts and specialists who are prominently identified with the devices and subjects under discussion are expected to take part, which will go far toward making the Convention an exceedingly important one from a technical and scientific standpoint. One especially important paper to be read will be that of Mr. W. S. Horry, on "The Reduction of Ores by Electricity," interesting on account of the large available water power at both ends of Lake Superior and owing to the fact that immense deposits of magnetic iron and copper ores are to be found on both sides of the lake.

No pains have been spared by the committee having charge of the Convention to make it not only one of the most instructive but probably the most pleasant and enjoyable meetings of the season. Owing to the large number of ladies who will be present, special entertainment for them has been thoughtfully provided. The accommodations and menu will be of the very best, and in view of the fact that special railroad rates are to be made, the Convention will furnish an opportunity for a most instructive, pleasant and economical outing.

Those desiring to avail themselves of this most enjoyable trip can obtain full particulars and state-room accommodation by addressing Mr. J. M. Hill, 1,240 Monadnock Block, Chicago.

* * *

Another Patent Decision Against the General Electric Co.

On May 5th, Judge Cox of the United States District Court at Utica, N. Y., dismissed the suit brought by the Edison Electric Light Company against the E. G. Bernard Company for infringement of patent No. 264,668 granted to Thomas A. Edison, September 19, 1882, for an alleged improvement in the compound winding of a dynamo. The Edison patent is now declared to be invalidated by a patent, No. 217,677, issued to Charles F. Brush for this same improvement. The object of the Edison invention is set forth in the specification as follows: "The object of this invention is to produce means by which the addition or removal of translating devices in the multiple-arc circuits of a system of electrical distribution shall cause immediately a proper regulation of the current energizing the field-magnet of the dynamo-electric machine supplying such system, and this without the use of adjustable resistances, or of any mechanism whatever except the ordinary circuit controllers of the lamps."

The earliest date assigned for the conception of the

Edison invention is August 18, 1879, whereas letters patent No. 217,677 were granted to Charles F. Brush on the 22d of July, 1879, or almost one month earlier. The machines made under the Edison patent did not operate in a satisfactory manner, and moreover were never a commercial success. Mr. Brush in his specification describes his invention as follows: "My invention relates to dynamo-electric machines and has for its object the maintenance in such machines of a magnetic field while the machine is running, whether the external circuit is closed or open."

The Brush dynamo was principally intended for use in electroplating devices. A number of these machines were built and were successfully operated long prior to the date of the Edison application. The defence set up was lack of novelty and invention and non-infringement. Action was commenced as far back as December, 1893; it was argued February 8, 1898, and was finally submitted March 9, 1898. The record contains some 2,453 printed pages.

The suit in question came about by reason of the E. G. Bernard Company having purchased from the Siemens & Halske Company a plant which they in turn sold to the U. S. Government for use in the Watervliet Arsenal at Troy, N. Y. The suit was defended by the Siemens & Halske Company through their able attorneys, Messrs. Barton & Brown of Chicago, and Mr. Seward Davis of Knox & Davis, New York. Great credit is due the learned counsel for their untiring efforts in hunting up and forcibly presenting the evidence.

The decision just rendered is very far-reaching, as the General Electric Company, which controls the Edison patent, has sought to extend the scope of the patent to include in its broad claims any dynamo having a compound winding of its field magnets, whether separately or self-excited, in combination with any translators in multiple-arc, whether lamps, motors or electroplating baths.

Under the Searchlight.

Notes and Comments on Various Topics.

HUDSON MAXIM, the inventor of explosives, who has offered to the United States Government his free services and all his inventions free of royalty for the building of a torpedo cruiser to cost \$5,000,000, says the boat he has in mind could destroy every Spanish warship which it might encounter. Dewey wants such a cruiser?

* * *

An electrician of Fort Wayne, Ind., is said to have invented a new system of turning down incandescent lamps. The apparatus as described consists of an arrangement of nine resistance coils so fixed that one or more of them may be thrown into the circuit and by increasing the resistance in the outside of the lamp reduce the amount of current passing through the filament.

* * *

THE whole of the Lower Bay can now be illuminated at night by means of a 400,000 candle-power searchlight located at Fort Hamilton. It was tried a few evenings ago for the first time and the light showed up everything, even below Sandy Hook.

* * *

PROBABLY the largest order for cruisers ever placed at one time was recently given by Mr. Marcus Nathan when he instructed a firm to deliver within one week a gross of war ships to be used in illustrating submarine mine explosions in Madison Square Garden.

* * *

THE Chicago Times-Herald contends that if Victor Hugo was right in saying "Every man is the son of his own invention" Dr. Gatling must be a son of a gun.

FIRST WEEK OF THE ELECTRICAL EXHIBITION.

MANY NEW AND STRIKING FEATURES ADDED.

Firing Submarine Mines by the Marconi System Attracting Wide Attention—Throngs of People Present—Attractive Company Exhibits.

The Electrical Exhibition which has now been running a week is, like a good wine, improving with age. During the first few days, in spite of the gigantic efforts made by the management, a number of exhibits were unfortunately not in place owing to a combination of unforeseen events, such as strikes, etc. At the present time, however, a large number of special features are in working order and are drawing large crowds both afternoon and evening. An excellent band of music tends to enliven things greatly by frequently playing patriotic airs. This Electrical Show, which by the way is but the second exhibition of the kind ever given in the city, comes before the public with the most complete and extensive display of electrical and kindred machinery and apparatus that has ever been presented in this country. Electricity is here demonstrated in all its uses and advantages, and men of experience are in charge not only of every detail of the Exhibition but are responsible for its success.

Mr. C. O. Baker, Jr., the President of the Exhibition Company, Mr. Marcus Nathan, the General Manager, whose experience in the previous Electrical Exhibition has been the groundwork for the success of the present enterprise, and Mr. T. C. Martin, the Chairman of the Auxiliary and Educational Committee, are all hard workers, and what they do is done with method, precision and earnestness. The New York Electrical Society, the oldest Association of the kind in the country, are sponsors for the Exhibition, as it is given under their auspices, and this Society represents in integrity and progress the vital electrical interests of the country. The Stationary Engineers, of which there are at least 5,000, as stated last week, will make the Madison Square Garden their headquarters and place of meeting during the month, and this organization represents the Western, Middle and the New England States, with intelligent and practical men who are continually in touch with new inventions and the improvements that are being made.

The magnificently illuminated tower high up on the great building is typical in its beauty and radiance of what is spread below, where electricity in its many forms of operation and development appeals to the interest, the taste or the curiosity of the spectator. Here are shown an electrical effect entirely new in the illuminated cascade; the illuminated fountain designed by Thomas A. Edison, Jr.; the tank in which is viewed the explosion of submarine mines and the destruction of boats by the Marconi system; the Edison ore extractor, a working model of which can nightly be seen; the Moore illuminated chapel with vacuum tube light; the exhibit of R. Thomas & Son Co., in which the paradox is exemplified that while 1,700 volts of electricity cause certain death, 100,000 would scarcely produce a tremor; 4,000 electrical fans in operation; a generating plant with a 600 horse-power boiler and engine to match which were installed in less than nine days when similar work ordinarily occupies a month; an exhibition of engines adopted by the U. S. Government; a theatrophone by which visitors to the Exhibition can enjoy not only the performances going on in New York theaters, but those as far off as Milwaukee, Wis. These are but a few of the extraordinary features of the Exhibition. Wherever one turns his eye, it will meet some object of interest. There is so much to be studied and enjoyed that discrimination would be inexpedient.

The generating department is a marvel in its way. The main floor is filled with exhibits which are of special value. The Concert Hall has a remarkable display of historical tableaux designed by Dr. Park Benjamin, and in the Assembly Room the illuminated chapel is shown. There is something for everybody in the building to see and enjoy. The telegraphic contests to take place this week, the lectures on scientific subjects, all make up an exhibition that only New York can support and to which every other city in the Union is glad to pay tribute.

The experiments by wireless telegraphy by the Marconi system and others are a revelation. A year ago but very few people were aware of the fact that it was possible to signal through space without the aid of wires. Last summer however Mr. William Marconi, a talented young Italian, following in the pathway of Lodge, Branly and other experimenters, found that it was possible to transmit signals through space to a distance of over ten miles. Mr. Marconi

inch from each other, and also two smaller balls placed about a half inch from each of the larger ones. The secondary terminals of the coil being attached to the smaller balls the sparks will pass across between all of the four balls, and these sparks passing in this way produce violent electrical oscillations which in turn generate invisible electric waves which go out into space in the form of ever-increasing spheres, something in the same manner as the ripple in a pool of water widening if a pebble is dropped in. These spheres have the power of passing through almost any material, the walls of a building or a crowd of people presenting no appreciable impediment to the passage of the waves.

Located in the center of the north gallery is a Clarke receiver, the most essential part of which is known as the coherer. The latter is a most interesting piece of apparatus and consists of a glass tube in which are fitted two sliding plugs of metal, so arranged that the distance between them in the center of the tube is adjustable, the space between the plugs being filled in with a prepared metallic powder. This powder when lying in its normal condition presents a very high resistance to the passage of the electrical current, often amounting to 20,000 ohms. When the electric waves from the transmitter strike this little coherer its resistance instantly decreases, often reaching as low a point as six or seven ohms. This enormous decrease in resistance allows the current from the single cell of dry battery to pass through the magnet coils of a tele-



WILLIAM MARCONI AND HIS WIRELESS APPARATUS.

accomplished this wonderful result by making some alterations in well known apparatus, and also by using at the transmitting and receiving stations a perpendicular wire suspended from a point high in the air; but while Marconi has accomplished much it has been left for the American inventor to improve and place upon the market apparatus which is suitable for practical use without requiring the constant attention necessary with the Marconi system.

Mr. W. J. Clarke, the well known electrical engineer, is the inventor of this new system, and the exhibit of his company in the Madison Square Garden certainly pays a high tribute to Mr. Clarke's inventive ability and business management.

In the center of the south gallery is placed the transmitter, which is contained in an insulated glass show case, and consists of a suitable storage battery which is connected to a specially constructed induction coil placed immediately above it, the current from the battery first passing through an automatic circuit breaker placed in front of the battery.

The circuit breaker takes the place for exhibition purposes that a telegraph operator would when repeatedly calling.

This, however, does not complete the entire transmitting apparatus, as the secondary terminals of the coil are connected to what is known as the "Clarke Electrical Oscillator," which consists of two large brass balls placed about a quarter of an

inch from each other, and also two smaller balls placed about a half inch from each of the larger ones. The secondary terminals of the coil being attached to the smaller balls the sparks will pass across between all of the four balls, and these sparks passing in this way produce violent electrical oscillations which in turn generate invisible electric waves which go out into space in the form of ever-increasing spheres, something in the same manner as the ripple in a pool of water widening if a pebble is dropped in. These spheres have the power of passing through almost any material, the walls of a building or a crowd of people presenting no appreciable impediment to the passage of the waves.

graph relay which is placed in circuit with the coherer. The relay magnets by their magnetism then pull up the armature, and this armature in its turn makes an electric contact which closes the local circuit of the apparatus, and clicks an ordinary telegraph sounder, rings a large vibrating bell, fires a cannon or mine, starts or stops a steam engine, or in fact can be made to accomplish anything that we wish in this direction. When the waves have acted upon the powder in the tube it still remains at its low resistance point, and therefore it would be impossible to send more than the one signal were it not for the fact that at the same time that the relay armature closes the local circuit it also throws a strong battery current through a pair of magnets which operate a vibrating hammer. This hammer continually vibrates against the glass tube as long as the local circuit is closed. Theappings of these vibrations against the tube tend to shake up the powder and cause it to return to its former high resistance, but as long as the waves are coming in from the transmitter the filings are not perceptibly affected by theappings. The instant, however, the waves cease coming, theappings shake up the filings, and they immediately return to their high resistance, when the local circuit is instantly opened and the telegraph sounder gives its up click, or if a bell is used it instantly ceases to ring.

Mr. Clarke's exhibit is so perfectly adjusted that

GARBAGE DESTRUCTORS.

BY A. E. BROOKE RIDLEY,
San Francisco, Cal.

The providing for the health and well-being of the population in towns and cities places heavy expenses upon the municipality. Among these expenses may be mentioned those for furnishing water and light and the removal of sewage and garbage.

Recently the attention of European municipalities has been specially called to reducing the expenses resulting from the necessity of repeatedly gathering and removing the refuse from households. Health experts finally decided that no method was so satisfactory as destruction by fire, and it was the custom to burn the refuse up immediately, mixing it with some more combustible fuel. It has lately been demonstrated that, providing the furnace was properly constructed, this refuse would burn without the addition of coal or other fuel. It was but a step from this to endeavor to utilize the heat that was going to waste, thus providing power for the operation of sewage pumps or electric light works.

The designers of these plants had to contend with two difficulties, the first of which was the fact that a certain amount of refuse had to be collected and burnt each day, and second, that this regular consumption would necessitate a steady instead of an intermittent production of steam, while, especially in the case of electric light works, a very heavy production of steam would be required for the three or four hours out of the twenty-four and very little at other times. Two methods of minimizing this difficulty were employed: one, that of storage batteries, and the other by a system of storing steam. Both these systems are in use in the Shoreditch plant and the storage battery one in the Oldham plant in England.

There are three principal systems of destructor plants, one system being used at Shoreditch, a district of London, the second at Ealing, and a third at Oldham.

In the Shoreditch plant a destructor cell is placed on either side of the boiler (Fig 1). In this system the refuse brought in by carts is dumped into a trolley car, then raised by an electric hoist (Fig. 2) to a platform on top of the cells, from whence it is run by electricity to the openings of the hoppers and dumped into the cell beneath. This system necessitates the consumption of a portion of the power generated in the operation of the electric power and also two crews of men.

In the Ealing system the boilers are placed back to back and the refuse is taken up on top of the cells on an inclined roadway.

In the Oldham plant the cells are all placed alongside each other, opening into a common flue, the heat from each cell augmenting the heat passing through the flue. At the end of this flue is a heated chamber, in which all particles which may escape from the cells become lodged, and which further, by its intensity, entirely deodorizes the products of combustion. It has the further advantage of consuming anything that is too large to be put into the cells; for instance, dead horses and other animals are entirely destroyed after being a short time in the chamber. From this chamber the heat passes under the boiler or boilers to the stack; and it is worthy of note that no objectionable smell results from this system. A steam injector system is employed to increase the combustion.

The illustration marked Fig. 3 shows a sectional elevation through one cell of the Oldham furnaces. As may be seen, the refuse is brought in by the town carts to an elevated roadway and from this is tipped on to a collecting platform adjacent to the furnace. The door through which the refuse is fed is on this side and opens directly on to an inclined "dead-plate" which in this particular case is of masonry. The door at the other side of the furnace is for

clinkering. The furnace bars form a continuation of the dead-plate and are also inclined to assist in feeding the fires. The dead-plate and furnace bars form the floor of a masonry cell which is arched at

the cells from the back, the fireman in front raking the refuse forward as he requires it.

The success or failure of all these plants is dependent on the cost of operation and the character

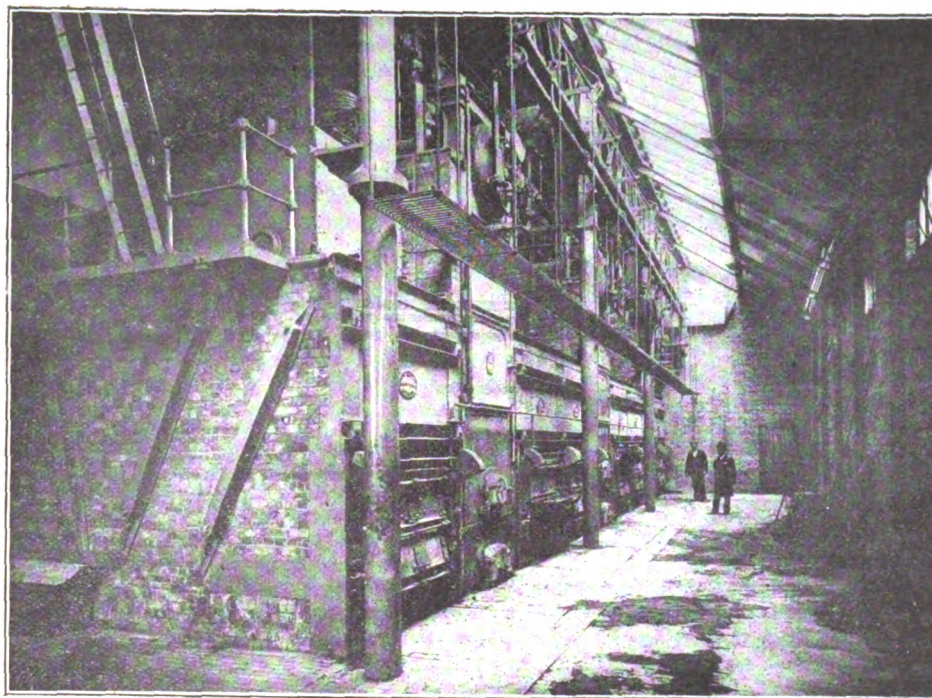


FIG. 1.—DESTRUCTOR CELLS AND BOILERS AT SHOREDITCH.

the top and has above it a masonry chamber. The whole is usually constructed of brick or some refractory material, whilst the entire structure is held firmly together by iron buckstaves.

The whole electric system of the town is operated

of the refuse supplied. For instance, where fuel was cheap and the weather was sufficiently cold to necessitate a large number of household fires, the orders collected generated a large amount of heat. On the other hand, a good deal of the vegetable

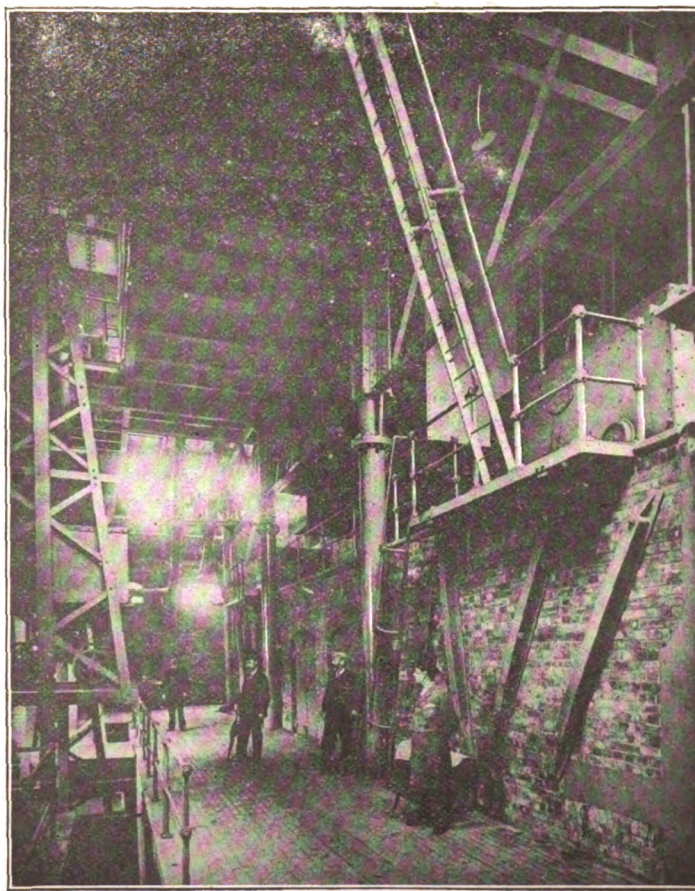


FIG. 2.—ELECTRIC LIFT FOR REFUSE AT SHOREDITCH.

by this plant, no coal being used, the storage battery carrying the peak of the load. The refuse is brought in on a slightly inclined platform to the back of the cells and is then dumped down and shoveled into

refuse is almost non-heat-producing.

In the installation in any town in America of a garbage destructor plant a complete investigation would have to be made of the conditions ruling be-

fore any estimate could be made of the saving that a city would make in installing a plant of this character.

The practical work at Oldham has proved that eight tons of town refuse, including the market sweepings and dustpan contents, is destroyed per cell in twenty-four hours, and the heat that is obtained is approximately 1,400° Fahrenheit.

The labor cost of plants in various towns in Eng-

land may be given approximately as follows, wages of the men being the same in every case :

Oldham, 6 cells, 19½ cents; Royton, 3 cells, 25 cents; Leeds, 12 cells, 19½ cents; Bradford, 12 cells, 19½ cents; Warrington, 2 cells, 23 cents; Toxteth Park, 6 cells, 25½ cents; Liverpool, 12 cells, 25½ cents; Dewsbury, 2 cells, 27½ cents.

SOME RECENT IMPROVEMENTS IN ACCUMULATORS AND THEIR APPLICATION TO TRACTION ON COMMON ROADS.*

BY J. T. NIBLETT.

(Concluded from page 246.)

To accurately test a storage cell is no easy matter, and unless great care is exercised very fictitious results may be obtained. A laboratory test as a preliminary may be very well, but for practical results such tests should not be relied upon. Testing under actual working conditions and for an extended period is the only reliable means of ascertaining the capabilities of cells intended for traction work.

We have already shown that no one type of cell is capable of doing all the very varied kinds of work accumulators are now called upon to do. Before building up a battery it is, therefore, wise to ascertain definitely the class of work it is intended to do, and construct accordingly.

To obtain a capacity test by discharging through a constant resistance, noting the fall of current and potential, is quite easy of manipulation, and is much used when comparative tests only are required. A more reliable method, however, is to discharge at a constant current, stopping when a prescribed fall of potential occurs. For traction work, where a uniform output for a given number of hours is required, it is very much the best plan to take the capacity of the cell in terms of watt hours. Under these circumstances the discharging rate in watts must be kept constant. Testing for local action, noting the effect of high rates of charge and discharge, are more serious matters and require careful manipulation.

The internal resistance of a cell depends upon the total active surface area of the opposing plates, the nature of the electrolyte and its condition and temperature, and the distance between the plates.

There are many methods for determining the internal resistance of batteries. If the cells be as

nearly as possible of the same dimensions, capacity and state of charge, then two cells may be placed in opposition (poles of like polarity joined together) and their joint resistance may be measured by the ordinary Wheatstone bridge method. If the cells be exactly similar, then one-half the resistance indicated will represent the resistance of each cell.

A far more reliable and accurate means of ascertaining the internal resistance of cells is the differ-

ential method, as expressed by the following formula :

$$r = \frac{D - D'}{D} R$$

where r is the resistance required, D and D' are the values of deflections obtained on a high-resistance sensitive galvanometer, and R expresses the value of a small but known resistance, used as a shunt.

When making tests by this method, a high-resistance potential galvanometer should be used, and one whose scale readings are either of uniform value or whose tangents are strictly proportional to the angle of the deflections. To determine r we have to obtain a deflection, D , when the cell is on open circuit, and then obtain another reading, D' , when the cell is shunted by R , then by the formula given the internal resistance may be ascertained. The shunt resistance R should be small in comparison with the galvanometer coils. Good results may be obtained if the resistance of the galvanometer is, say, 5,000 ohms, and the shunt not more than 1 to 5 ohms.

The total current or energy capacity of a storage cell is the maximum amount of current or electrical energy which it is capable of storing, without reference to any loss that may occur by it being allowed to remain idle, nor does it take into account the rate or manner of its discharge.

The working current or energy capacity is that amount of current, or electrical energy, which can be obtained from the cell at any specified rate of discharge. When estimating this, the discharge is always stopped as soon as the cell ceases to do useful work. The working capacity of storage cells may vary between very wide limits.

The absolute current or energy efficiency of an accumulator cell is the ratio between that amount of current or energy put into it and that obtained by a total discharge, without reference either to its rate of charge or discharge or to the time allowed to elapse between these operations.

The working current or energy efficiency of a storage cell is the ratio between the value of the current or energy expended in the charging operation and that obtained when the cell is discharged at any specified rate.

In a lead storage cell, if the surface and quantity of active material be accurately proportioned, and if the discharge be commenced immediately after the termination of the charge, then a current efficiency of as much as 98 per cent. may be obtained, provided the rate of discharge is low and well regulated. In practice it is found that low rates of discharge are

not economical, and as the current efficiency always decreases as the discharge rate increases, it is found that the normal current efficiency seldom exceeds 90 per cent., and averages about 85 per cent.

As the normal discharging electromotive force of a lead secondary cell never exceeds 2 volts, and as an electromotive force of from 2.4 to 2.5 volts is required at its poles to overcome both its opposing electromotive force and its internal resistance, there is clearly an initial loss of 20 per cent. between the energy required to charge it and that given out during its discharge. The normal discharging potential seldom exceeds 2 volts, and as this pressure is continually being reduced as the rate of discharge increases, it follows that an energy efficiency of 80 per cent. can never be realized. As a matter of fact, a maximum of 75 and a mean of 60 per cent. is the usual energy efficiency of lead-sulphuric-acid storage cells.

What the ordinary commercial man will be most interested in are tests which give him reliable information as to the cost of the up-keep and life of the battery; also data as to the initial cost and as to the mode of it doing its work. Such information cannot be obtained in a laboratory and has to be obtained by actual trials.

Perhaps a short description of one or two of the present applications of secondary batteries for propelling motor-cars will best serve to show the usual method of practically dealing with them.

In this country the vehicles put upon the London roads by the London Electrical Cab Company may be looked upon as a pioneer enterprise, and its development will be watched with the closest interest by all those concerned.

In appearance the London electric cabs are similar to the "coupé" type of horse vehicle. The inside is upholstered in leather, and the comfort of the passengers seems to have been studied in every way. At night the interior is lighted by an electric lamp, while the outside is rendered resplendent by two brilliantly-lighted side lamps.

The driver's seat is in front, and is placed much in the same position as in the ordinary four-wheeler. The dashboard is rounded instead of being flat, and this tends to give the vehicle a less angular aspect than it would otherwise have. Immediately in front of the driver, the starting, stopping and steering gear is placed. The battery used is a special Faure-King type, and is supplied and maintained under contract by the E. P. S. Company. The plates used are thin, and to prevent the active material being "washed" out, the surfaces are covered with a layer of silicated asbestos held in position by thin sheets of perforated vulcanite. The whole of the cells are mounted in a tray, which is slung underneath the cab by four suspending links. These links are supported by springs under compression, and as an extra safeguard against vibration the ordinary carriage springs again support the battery tray. The total weight of the battery is 14 cwt. The total weight of the complete vehicle, including driver and its full complement of passengers, is approximately 30 cwt. The electric motor used is one of the Johnson-Lundell type with double windings on both fields and armatures, and is capable of developing at normal speed about 3 HP. The motor, which is placed in the hind boot, is connected by gearing to a countershaft and thence to the back wheels by an endless chain. This driving chain is of the Renolds laminated type. The sprocket arrangement usually employed is dispensed with, and as the chain runs on the pinion and chain wheels with some side play it is worn evenly and is found to retain its efficiency until it is completely worn out.

The starting, stopping and back driving arrangements are of simple construction. On the left hand side of the driver's seat a lever handle is placed; when starting, the lever is pushed forward and by a stepping-up arrangement the more forward the lever is pushed the faster moves the vehicle. Drawing

* Paper read before the Self-Propelled Traffic Association, Liverpool Center, Eng., March 29, 1898.

back the lever slackens speed, and when drawn beyond a stationary point the carriage runs backward.

One of the chief novelties claimed for these cabs is the double winding of the electric motor. By adopting this system great economy of battery power is said to be effected. The starting lever on its first outward step connects the two armature windings and the two field windings in series, a small resistance being also thrown in. The second step puts the resistance out. The third places the armature coils in parallel, but leaves the field coils in series. The fourth and final step places the field coils in parallel and gives the vehicle its maximum speed. The first step is only used for starting. When the lever is brought to the second, third and fourth steps, the cab attains speeds of 3, 7 and 9 miles per hour respectively. By the employment of the stepping up and down arrangement the cab is brought under complete control, whilst the reversing mechanism, in addition to a foot-brake arrangement which is fitted, enables stopping and backing operations to be more quickly carried out than would be possible in a horse-drawn vehicle.

The current from the accumulators is made to pass through a switch attached to the foot-brake, so that whenever the foot is applied to the brake the current is disrupted, thus avoiding all possibility of damage to the motor should the cab be brought to a standstill while the current is still on. As another safeguard, the driver of each cab is supplied with a special key-plug, which he carries about with him. This plug is used as a switch, and makes or breaks the battery circuit whenever it is inserted or withdrawn, the obvious advantage being that if the driver leaves his cab, taking the key with him, it is impossible for anyone to tamper with or start the vehicle.

The arrangements for taking out, reinstating and charging the batteries are not at all complicated. According to the present arrangements the charging is only done at the company's charging station. The cabs are run over a hydraulic table on which a tray of cells is wheeled, the tray being brought out on a light trolley. The table is now raised until the battery is brought into its right position for attachment to the suspending links. When fixed the table and trolley are lowered and the cab is free to propel itself away. For removing the discharged batteries the reverse operation takes place. When removed the battery is placed on a second trolley and is run into its proper charging position. While charging, one of the conductors runs direct from a common return to the battery. The other conductor carries the current through a variable resistance used for regulating the amount of current flowing, and also through an amperemeter which indicates accurately the rate at which the charge is being given. The batteries in all cases are joined to the charging source separately, and each has its own regulating and measuring arrangements, thus ensuring an effectual charge.

It is said that to remove an exhausted battery and reinsert a charged one does not occupy more than five minutes, much less time than is required to take out and put in a fresh horse in an ordinary cab.

The battery consists of 40 cells, and as previously stated, it weighs complete about 14 cwt. The capacity of each cell is 170 ampere hours at a normal discharging rate of 30 amperes. The electrical pressure at the battery terminals is 80 volts. Thus the battery has a storage capacity of 13,600 watt hours at a discharging rate of 2,400 watts, or about 3½ electrical HP. When fully charged the battery is said to be able to run the cab a distance of 50 miles over the ordinary London streets. The mean current drawn from the battery when on a level road is 30 amperes, on rougher roads from 40 to 45 amperes is required, while climbing steep gradients the cells are called upon to give as much as 120 amperes. The motor, although constructed to give a normal output of 3 HP., is capable of a maximum of 4 HP.

without unduly heating, so that a margin of 25 per cent. is obtained for eventualities.

In New York some electric hansom cabs have recently been put on the roads. The cabs are made by the Electric Carriage & Wagon Company. In some respects they resemble our London hansoms, but the vehicles are fitted with four wheels instead of two. The back wheels are used for steering and the front for driving. The chief feature of this cab is that two motors are used, one for each of the driving wheels. By employing two motors, various variations of speed can, of course, be obtained by running them in parallel or series; and by having each wheel under separate control quicker turning power of the vehicle can probably be obtained. This is doubtless the object the designers of the New York hansoms had in view, although it is very problematic if any real advantage is gained by such an arrangement.

The New York cabs are said to weigh 3,000 lbs. Each motor develops 1½ HP. with 75 volts, and at a speed of 800 revolutions per minute. This represents a speed of 8 miles per hour for the vehicle. The battery used consists of 44 cells placed in trays containing 11 cells in each. The four sections are placed in a receptacle in the rear of the vehicle. No loose terminals are used, contact between the sections and other parts being established by means of plates and contact springs. Each cell contains three plates of the chloride form, and they have a useful capacity of 100 ampere-hours when discharged at 21 amperes—the normal rate. The whole battery weighs 900 lbs. Speeds varying from 4 to 15 miles per hour can, it is said, be obtained with varying battery discharges of from 12½ to 40 amperes.

L'Electricité Société Anonyme of Brussels have recently introduced an electrically propelled dog-cart. In this vehicle, and according to the usual practice, the battery cells are placed underneath the seats. Forty-eight cells of the Planté type, having a capacity of about 75 amperes, are used. The total weight of the battery is 850 lbs. The motor is wound with the coils of the fields and armature in series, and it weighs about 260 lbs. A speed of 1,750 revs. per minute is attained with a battery discharge of 21 amperes. The motor is connected to the driving wheels by reducing gear and chain bands, while differential movements of the driving wheels are obtained by the use of an intermediate clutch.

The dog-cart has four wheels and is made to seat four passengers, including the driver. The carriage, including batteries, motor and gearing, weighs complete about 2,500 lbs. The maximum speed is 10 miles per hour, and at this rate it is stated a distance of from 40 to 50 miles can be traveled with one charge of the battery.

As a means of regulating speed in a self-contained motor-car, actuated by batteries, two methods are at present in vogue. The first is by splitting up the battery into sections by a suitable commutating arrangement, thereby putting the sections either in series or parallel as required. The objection that may be raised to this plan is that the cells may be unequally discharged. A more practical method, and one adopted on the London cabs, as explained, is using the battery as a complete unit, and obtaining the various speeds by commutating the coils in the fields and armatures of the motor. It is possible that some method may be adopted by which the motor may be run at constant speed, while the speed variations in the car are obtained by suitable gearing. According to present practice the motor, when starting the vehicle, is running slowly, and therefore in its most inefficient condition. If the constant speed idea were utilized, the motor might be of smaller power, and it could also be run at a higher and more uniform efficiency.

As regards the prevailing method of connecting the motors to the driving wheels by the system of gearing, probably with our present knowledge it is the best that can be done. Some way of dispensing with gear and running direct will probably be de-

vised. If this could be done, not only would it lead to great economy in working, but it would greatly add to the comfort of the passengers. When riding, for instance, in one of London's electric cabs, in addition to the hum of the motor, which is not at all unpleasant, one's ears are assailed by the clanking and rattling of the gearing and chain. If direct running or some more silent method of gearing could be devised it would be a desirable improvement. Improvements in the wheel tires will doubtless be made, and such improvements would tend to reduce road friction and thereby save power or give increased speed. They would also reduce the depreciation in the working parts and give the battery a better chance.

Methods of electric locomotion on common roads present enormous possibilities. Electrically-propelled omnibuses, broughams, dog-carts and light parcel delivery vans may now be seen running along our thoroughfares. There is no reason why the same plan should not be adopted for driving vehicles for the cartage of goods generally. In the latter case appearance need not be studied to such an extent as in the passenger-carrying conveyances; therefore, in this case the electrical engineer would have a freer hand, and better results might be anticipated.

Methods of recharging will have to be seriously considered. There seems no reason why in all our large towns charging centers should not be established. The ordinary cab is stationary a great part of the day; and there seems no valid reason why the charging operation should not be rendered so simple that a cabman of ordinary intelligence could easily perform it. With an "in-and-out" electricity meter placed on the vehicle in a convenient position on the battery circuit, the driver could see at a glance how much energy had been put in and taken out of his battery, therefore would know when a recharge is required; also, when charging, by reference to the meter he could see when his battery is satisfied. Such a measuring instrument with the small range required need not be an expensive addition. A supply system worked on the penny-in-the-slot principle could easily be arranged. The battery, of course, would not be removed, but would be connected up to the source by suitable flexible mains. Under these conditions the driver could buy his supply of electricity much in the same way as a carman can now buy fodder for his horses.

The form of battery required for driving a self-contained motor-car over common roads may need to be of a different nature to that required in cars running on a permanent way, where the tractive force remains more nearly constant and where there is less jolting and vibration. Possibly some form of mechanically solid cell with a Faure type negative and a Planté type positive element will fulfil the requirements.

As to the probabilities of the self-contained electric motor-car comparing favorably with horse haulage, this will entirely depend upon its economic aspect. However great the convenience of electric haulage, however great its reliability, ease of manipulation, sanitary aspect and general convenience, the question as to whether it is best or not has still to be satisfactorily answered. In its present experimental stage trustworthy figures of the daily or weekly cost of up-keep cannot be expected. It is only by taking the average expenses incurred during months or years that anything like an accurate estimate can be arrived at. The initial cost and cost of maintenance of the batteries employed will, we believe, be the controlling factor. Whatever turn the idea of electrically-propelled motor-cars may take, it must necessarily always involve the use of some apparatus for storing and giving out electrical energy.

The modern secondary battery leaves very much to be desired, but still there are several very good batteries for this purpose obtainable, and these may serve to tide the electric traction man over the period intervening before the advent of the ideal cell which we all wish to see.

SYSTEM FOR PROTECTION OF RAILWAY TRAINS.*

BY EMILE DIRUDONNE.

The catastrophe of Péage de Roussillon is still fresh in the memory of a large number of persons, and although many other deplorable railway accidents have since occurred, this one is vividly remembered in all its hideous sadness. A train for some reason is obliged to stop between stations on an inky black night, while into it plunges another train following the former by ten minutes. The horror of such a situation can readily be imagined.

Where a train is brought to a standstill along the line through some unforeseen casualty, the working rules prescribe certain measures to be taken for the protection of the train against an accident similar to the memorable one just referred to.

Are these frightful misfortunes the price that has to be paid for improvements on the realizations of weak humanity? No sooner does the evil appear before suggestions as to a remedy spring up on all sides. Place on the locomotive, say some, a siren that could make itself heard a distance of several kilometers, overcoming the noise made by a moving train. Others suggest the use of an immense gong.

MM. Chauvin and Baulan, well-known engineers, have carefully studied this perplexing problem, and have devised a protecting system whereby a train stalled at any point along a line would be enabled to immediately communicate the fact to the various neighboring and protecting points such as stations, signal towers, etc. The arrangement permits of the conductor entering into telephonic or telegraphic communication with the operators in the near-by stations or signal towers, or in the event of the operators failing through any mishap to respond, the conductor can, by means of suitably arranged signals, announce to trains approaching from either or both directions the presence of the disabled train.

The system that these engineers have designed consists in a closed electric circuit stretched along the line of the road between the protecting stations and in a service of electric energy carried by each train and which can at will be introduced into the main circuit at any point along the line. The closed circuit controls annunciator apparatuses located in the protecting stations, and as soon as the conductor on the stalled train has cut into this circuit, the source of electric energy carried by the train, the annunciator at the station just behind or just ahead, or both, operate and inform the attendants that it is necessary to protect the train in that block.

The closed circuit may also be made to operate a semaphore or other suitably arranged signals placed at given points along the line, to warn trains in both directions that they are approaching a train at rest.

It will very readily be seen that such a system would prevent or greatly lessen the chances of a collision.

Fig. 1 shows a section of track to be protected, assumed to be guarded by the two towers C and C'. These latter are connected by the closed circuit A B, in which is placed at each tower an electric gong, c and c'.

The circuit may be either of the metallic type or of a single wire with the ground as a return. In Fig. 1 there are two conductors, strung on the telegraph poles D D'. On each of these poles, either one (pole D') or both (pole D) of the wires are carried down, terminating at a convenient height from the ground in a switch. The latter is so arranged as to allow of its being readily opened, and permits the introduction of the battery wires from the train. As soon therefore as a train is obliged to stop, the conductor goes to the nearest pole while unwinding the wires E F (Fig. 1) connected with

the battery on the train. He breaks the circuit A B and attaches the ends of the wires he is carrying to those of the line.

If he connects the two wires E F to 1 and 2 or to 3 and 4, that is to say, to only one of the line wires A or B, the annunciators in both of the stations C C' are simultaneously acted upon. If, on the other hand, he connects the wires 1, 3 or 2, 4—that is to say, to both of the line wires A B—the circuit of the rear tower, or of the tower directly ahead, is a line closed and the bell in one of these towers alone rings.

If only one of the line wires (post D') is brought

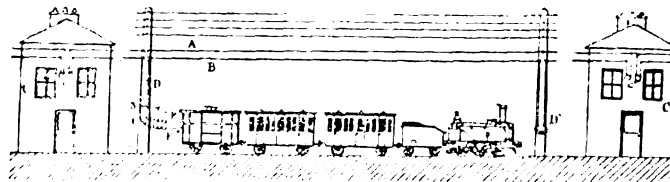


FIG. 1.

down to within reach, the two bells c and c' are always operated together, unless, however, the bell at one tower alone is in circuit, which might suffice in certain cases.

This system gives the train to which an accident has occurred the means of blocking itself, or in other words enables it to signal the fact of its being at a standstill to other trains along the line both ahead and in the rear, without its having to pass through the safety towers. It is only necessary for this

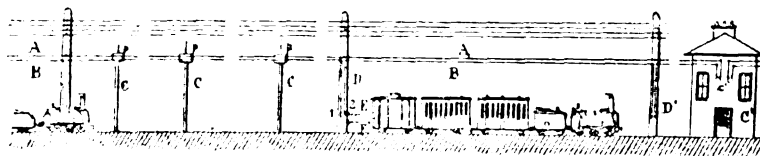


FIG. 2.

purpose to establish at equal distances along the line of the track suitable signals to be operated by the train batteries, in the same way that electric semaphore signals are worked. Fig. 2 shows a train that has blocked itself in the rear by moving a series of disk signals by placing its battery in circuit with the line by means of the neighboring pole D.

Several types of annunciator may be employed—optical apparatus, acoustic apparatus or a combination of the two. They may, in the opinion of the inventors, be directly operated by the current which flows along the line, or be only unlatched by this current, the work of operating thus being accomplished by some local source of mechanical or electrical energy.

It is readily understood that instead of simply placing in the closed line circuit a battery, with a view to causing the operation of a bell, the train conductor may place in this same circuit a telephone or telescriptor, which would enable him to enter

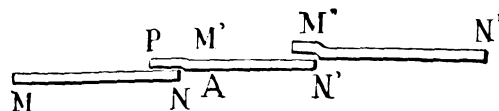


FIG. 3.

into communication with the operator in a neighboring tower either to make an explanation or to ask for help.

MM. Chauvin and Baulan think that their system could be employed advantageously as a block signal system.

It would then be necessary to install it in the following manner: The line of the road would be divided into sections of say 10 kilometers in length. Along these 10 kilometers a closed circuit would run, always accessible however, and attached to a series of optical, acoustic or other signals. If at any point a train is obliged to stop, the source of electricity with which it is provided is placed in the main circuit, and immediately the

signals along the line move to the danger position and warn the train which is following.

There would seem to be a defect in the above system, which, however, the inventors have met and overcome. This is where a train is obliged to stop at a point A, Fig. 3, at a distance of less than a kilometer from the beginning of a block or section, M' N' for example. Under such circumstances the train following, not being warned in time owing to the insufficient distance allowed it for stopping, would occasion a collision.

To obviate this danger it was suggested that the line of track be divided, as first proposed, into sec-

tions of 10 kilometers in length, but that the closed circuit be made to operate over a distance of 11 kilometers, or in other words overlap the track section. With such an arrangement (Fig. 3) a train stopping at A would be protected by the danger signals on M' P.

The solution of this difficult problem is extremely interesting. To the best of the writer's knowledge, however, this system has not as yet been tried on a practical scale. After having called the attention of

railway companies to the invention, our next desire would be to see it given a fair test.

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XIX.—Bullion Refining.

In the year 1851 Charles Watt obtained a patent (No. 13,755) to which reference has been made more than once previously in these chapters. This patent may certainly be regarded as the master patent of the electro-chemical industries, for not only did it clearly set forth the conditions necessary for the production of chlorine, alkalis and chlorates from solutions of potassium or sodium chloride, but also the method and details of procedure to be adopted for refining by electrolysis alloys of copper, silver and gold. This patent was of course forty years before its time, and even had it been filed in 1891 instead of in 1851, it is questionable whether it could have been upheld in a court of law; but it is nevertheless of great interest as showing how early the idea of using electricity for the conduct of chemical and metallurgical operations upon an industrial scale was formed.

The principle of the method to be used in refining operations is clearly set forth in this patent of Watt's, and the electrolytic procedures used to-day for refining copper, silver and gold are simply developments of the ideas contained in this patent of 1851. Moebius, who is the patentee of the silver refining process in use in Europe and America at the present date, has of course much improved upon the plant and apparatus suggested by Watt for effecting the separation of silver and gold; and as the validity of patents in the electro-chemical and electro-metallurgical branches of applied science rests upon novelty in design of the plant and apparatus used, and

*Translated from *La Vie Scientifique*, Paris, for *ELECTRICITY*.

not upon novelty of principle, the Moebius patents are doubtless valid.

Gold and silver refining by electrolytic methods is carried on at three works in Europe, two being in Germany and one in Belgium. At Frankfort, the Moebius process is used for refining silver on a fairly large scale. This process is also in use at St. Louis, at Perth Amboy, and at Pittsburg, in the United States, so its main features are no doubt known to many readers of *ELECTRICITY*.

The plant at Frankfort is designed for an output of 35,000 ozs. silver per day of 24 hours. A 25 HP. gas engine drives a dynamo yielding 150 amperes at 100 volts. This current is passed through 60 to 70 cells in series, each requiring about 1½ volts. The vats are of pitch pine, and are coated internally with tar, and each vat is divided into seven compartments. In these are hung three rows of anode plates and four rows of cathode plates; the former are plates of bullion .40 inch thick each weighing 3.3 lbs.; the latter are thin sheets of rolled silver. The anodes are enclosed in linen bags. The electrolyte consists of a copper nitrate solution, containing one-eighth of silver, and during the electrolysis it is kept slightly acid by addition of nitric acid. In order to prevent short-circuiting the crystals of silver are continuously removed from the sheet silver cathodes and are allowed to collect upon a canvas tray suspended beneath the electrodes. They are withdrawn, washed, dried and fused at intervals in order to obtain ingots of fine silver. The refinery at Frankfort, known as the Deutsche Gold u. Silber Scheide Anstalt, is in a flourishing condition, as at the last annual meeting of the company noted by the writer (October, 1896,) a dividend of 12½ per cent. on the ordinary share capital was declared. This company has also an interest in one of the Niagara electro-chemical companies.

The Nord-deutsche Affinerie at Hamburg was one of the earliest, and for many years one of the most successful electrolytic copper refineries in Europe. Copper refining is still carried on at this works, but other electro-metallurgical operations have been taken up. One of the most successful of these is the parting of gold from platinum, which is conducted at this refinery on a considerable scale. This separation is effected by using plates of the gold-platinum alloy as anodes in an electrolyte of gold chloride solution, with thin sheets of gold as cathodes. The platinum under these conditions remains as a dark gray mud upon the bottom of the electrolytic vat. The process and apparatus are patented by German patent No. 90,276 of 1896. Recently some further details of the procedure adopted at Hamburg have been published,* and it is stated that by using a high temperature, an excess of hydrochloric acid and a current density of 90 amperes per square foot, no chlorine gas escapes at the anode, but that all is utilized in bringing the gold of the anode into solution. The gold obtained is absolutely pure, and the process is stated to be superior in all points to the older method of separation.

The third refining process, which may receive mention in this chapter, is one for parting silver from argentiferous lead, and is, according to Oettel, in operation in Belgium,† though he gives no details as to the locality or the extent of the operations.

When zinc is melted with argentiferous lead in order to remove the silver from the lead by the production of a zinc-silver alloy, considerable loss of zinc and silver occurs owing to the oxidation of the former. In the Rossler-Edelmann process this is avoided by adding ½ per cent. aluminum to the melt; the aluminum combines with the oxygen present as oxides of the other metals, and the separation of the fused mass into two layers is more effectual owing to the greater fluidity of the melt. The temperature of the mass before the addition of the alu-

minum should be 500° C. The alloy of zinc and silver obtained in this way can contain up to 20 per cent. of the latter metal. It is cast into anode plates of suitable form, and these are used in an electrolyte of dilute sulphuric acid containing zinc sulphate. The zinc of the anode is dissolved and redeposited at the cathode, while the silver and the small quantity of lead present remain as an insoluble sludge upon the bottom of the vat.

Bullion refining, and the parting of the precious metals such as platinum and gold, can never from their nature become very extensive branches of the electro-chemical and electro-metallurgical industries; but the facts given above show that the use of electricity in this highly specialized branch of metallurgy has already attained considerable development, and the future is certain to be marked by a steady, if slow, growth of the industrial applications of electrolytic methods in parting and refining the precious metals—platinum, silver and gold.

ANNUAL MEETING OF THE GENERAL ELECTRIC COMPANY.

It Was Resolved That Something Ought To Be Done to Adjust the Impairment of Capital!

SCHENECTADY, N. Y., May 10, 1898.

The Sixth Annual Meeting of the stockholders of the General Electric Company was held here at noon to-day, pursuant to notices issued on the 25th ult. The meeting was held as usual, not in the regular office of the company, because that is just outside of the city limits, but in the small lodge or gate-house at the entrance to the grounds occupied by the works of the corporation.

The stockholders were called to order promptly on the stroke of noon. President Coffin was made chairman and Mr. Westover was named as secretary of the meeting. At no time were more than a baker's dozen present. Besides the president there were in attendance Directors Gordon Abbott and Robert Treat Paine, 2d, of Boston, and George Foster Peabody of New York, Vice-Presidents Joseph P. Ord and E. W. Rice, Jr., and Treasurer Henry W. Darling, with G. E. Emmons, manager of the local works. The others present were all employees of the company with the exception of one shareholder from Boston.

The business, as announced in the call for the meeting, was to elect a full board of directors for the ensuing year and to attend to such other matters as might properly come up. Nearly 500 shares of stock were voted by the holders in person and over 210,000 were voted by proxies. Of this latter number Messrs. Abbott, Ames, Ord and Paine held proxies for over 209,000 shares. When we remember that the total number of shares of stock of both kinds is 347,120, it will be seen that these gentlemen had a good working majority, standing in fact at all times over 300,000 votes above the fear of contradiction.

There was but one ticket in the field and it was elected. The directors for the next year are the same as the directors for the last year. Their names are: Gordon Abbott, Oliver Ames, C. A. Coffin, T. Jefferson Coolidge, Jr., C. H. Coster, Thomas A. Edison, George P. Gardner, Eugene Griffin, F. S. Hastings, Henry L. Higginson, J. Pierpont Morgan, Robert Treat Paine, 2d, George Foster Peabody.

The usual routine of business was duly gone through with. There were inspectors of election, who kept the polls open for one hour, though one minute would have been sufficient. All the minutes of meetings and reports, and all the acts of all officers and directors were duly approved, ratified and confirmed. A committee, consisting of Messrs. Felton, Emmons and Dodge, was appointed in the usual way to make the report exacted by the Massachusetts statute.

One departure from routine, however, was made

to-day, and those who were present are not yet done with conjecturing who is responsible for it. If any director knew beforehand what was coming he kept his secret well.

Heretofore after declaring the polls open and doing the other usual things, it has been the custom for all present to adjourn at about a quarter past 12 o'clock in a body for a recess, which has always been spent in discussing a collation spread in the office of the company, in order to assist the passage of time while the slow hour-glass, which had been inverted on the first announcement as to the polls being open, was running its appointed course. To-day, however, there was no recess. Instead there was discussion, which took a wide range and resulted in the most significant vote which the company has taken for four years.

Under the head of miscellaneous business, the president asked if there were any questions or other matters to be brought before the meeting, whereupon a shareholder asked him about the value of the patents and franchises which are carried on the books at \$8,000,000. The answer was that this valuation was excessive and would need to be revised, but such revision could be had most conveniently and advantageously in connection with a proposed reduction of the capital of the company, action as to which could not be much longer deferred.

Some one asked how the \$2,000,000 of bonds reported as bought and cancelled had been obtained—that is to say, whether by allotment or by purchase in the open market—and the answer was that the company had gone as any other buyer into the open market and purchased its bonds where it could get them.

Encouraged apparently by the remark of the chairman that some reduction should be made in capital account, a member said that there should be no half-way measures. Another remarked that the capital should not exceed the gross earnings for one year, but the chairman questioned whether in a business like that of this company the entire capital could be turned over every year, although he admitted that the principle of making capital equal to gross earnings for one year was a sound one in other kinds of business.

To a remark that the two old constituent companies, viz., the Edison General Electric and the Thomson-Houston, which combined to make the present company, had each earned gross nearly as much as the present gross earnings of the General Electric Company, it was said that the times had been bad and prices are and have been low.

It was agreed by all that the assets of the company must be made somehow to balance its liabilities. The \$11,725,000 deficit exists even with patents and franchises standing as an asset valued at \$8,000,000. If this asset alone should be written down very materially, it would almost necessitate the reduction of capital one half to make assets balance liabilities. Then too there are the stocks and bonds held by the company. The situation is a grave one and not to be dealt with lightly.

Just at this point one of the smaller stockholders offered a resolution of a sweeping character. It declared the sense of the meeting to be that no time should be lost in reducing the share capital and scaling down the preferred stock so as to be able to resume dividends.

This resolution was of course voted down, but it had a surprising amount of support. The Boston directors said that they could never get any more proxies from their constituents if they allowed such a resolution as that to prevail, and so their 209,000 votes were thrown against it. It is supposed that Boston holds all but 4,000 shares of the preferred stock.

The influences behind the movement for some expression on this point were, however, too strong to be denied, and they succeeded in having all unite upon a resolution that the interests of the company

*T. Ulke, in "The Mineral Industry" Annual for 1896.
†"Die Entwicklung der Elektro-chemische Industrie," 1897.

demand that the proper and necessary adjustment of the impairment of its capital should be promptly made, with a view to the speedy resumption of dividends. No vote was cast against this resolution, which, if it means anything, means the same thing as the one which Boston would not have.

This vote terminated the proceedings. The hour of adjournment was about half-past 1 o'clock.

It was the liveliest annual meeting that the company has had for years; that of last May was notably dull compared with it.

The New York Electrical Society.

The 187th meeting of this Society will be held in the Concert Hall, Madison Square Garden, on Thursday, May 12th, at 8:20 P.M. There will be a short session for the transaction of current business and at 8:30 Dr. Schuyler S. Wheeler will lecture on "Electrically Driven Machinery."

The lecture will be illustrated by experiments and lantern slides. The evolution of electrical machinery as influenced by the gradual change from belt driving to electric driving will be traced, and the modifications of design making for greater simplicity thus rendered possible will be demonstrated.

Admission to the Garden can be had by the special ticket issued to the members of the Society, which can be obtained—price 25 cents—from the Society's booth at the Exhibition any night from 8 to 9, or on application to the Secretary. Ladies are admitted to the lecture, but each ticket gives admission to the building to only one person.

LEGAL NOTES.

A foreclosure sale will take place at Richmond, Staten Island, at noon on May 26 of all the rights, privileges, properties, leases and franchises of the Staten Island Traction Company, formerly the Port Richmond & Prohibition Park Electric Railroad Company, including its appurtenances, merchandise, dynamos, engines, rolling-stock and all property acquired in the construction, operation and maintenance of its electric railroad. The plaintiff in the suit is the Central Trust Company.

Justice Scott in the Supreme Court has denied the application of Thomas E. Leeman, one of the minority stockholders in the Municipal Electric Light Company of Brooklyn, N. Y., for a mandatory injunction, pending trial, to restrain the Edison Electric Illuminating Company of Brooklyn from carrying out a plan of reorganization, on the ground that the scheme had not been agreed to by two-thirds of the shareholders of the Municipal Company, and that the terms of the agreement to purchase the plant of the Municipal Company were not in accordance with law. Justice Scott holds that the Edison Company has done all that is necessary up to the present time legally to carry out the proposed arrangement.

Maurice McCarthy, 14 years old, through his father, James McCarthy, as guardian *ad litem*, obtained a verdict of \$13,750 against the New York & New Jersey Telephone Company and the Municipal Electric Light Company in the Supreme Court in Brooklyn on the 30th ult. The boy lived in a building the lower part of which the former company occupied and had wires strung in the cellar. While chopping wood in the cellar the boy came into contact with the live wires, and two of his fingers were so badly burned that they were amputated. It was contended that the wires were strung in a careless manner.

On the 6th inst., at Philadelphia, an opinion was handed down by Common Pleas Court, No. 2, in which it sustains the demurrers filed by the respondents in the suit instituted by James Madden and others, stockholders of the Penn Electric Light Company, against John Lowber Welsh, Thomas Dolan and others and the Edison Electric Light Company, to recover damages to the amount of \$500,000 for the alleged mismanagement by the defendants of the Penn Electric Light Company, to the advantage of

the Edison Electric Light Company. This alleged mismanagement was the renting for a nominal sum to the Edison Electric Company of the conduits of the Penn Electric Light Company under a perpetual contract, thus destroying all competition by other companies for the use of the conduits. To this suit the defendants filed demurrers.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Bay City, Mich.—The council has passed an ordinance giving a street franchise to the new Bay, Tuscola & Huron Railway Company.

Chicago.—The court has granted permission to Gen. John McNulta, receiver of the Calumet Electric Street Railway Company, to expend \$60,000 in the improvement of the plant and the purchase of property for a terminal loop.

Chattanooga, Tenn.—A Washington dispatch published here states that the bill permitting the Chattanooga Rapid Transit Railroad to enter the Chattanooga-Chickamauga National Military Park has passed both branches of Congress.

Clinton, Mass.—A number of local business men intend to form a corporation to be known as the Clinton & Hudson Street Railway Company for the purpose of constructing and operating an electric road between Clinton and Hudson, through the town of Berlin.

Detroit, Mich.—The "News" states that "George E. Fisher, president of the Chase Construction Co., has closed a contract in Chicago with J. C. Shaffer for the entire overhead electrical construction of the electric railway from Detroit to Toledo. A million pounds of copper will be required to complete the road, which will be 60 miles long and built for heavy traffic. The road will be known as the Chicago, Toledo & Detroit Railroad. The Chase Construction Company will begin their work in about 60 days."

Greenfield, Mass.—The Legislature has passed the bill and it has been signed by the Governor giving the Greenfield & Turner's Falls Street Railway Company the right to carry merchandise in small parcels, baggage and mails. It does not become operative, however, until it has been accepted by a two-thirds vote of the voters of Greenfield and Turner's Falls at either a special or regular meeting.

Holyoke, Mass.—The Holyoke Street Railway Company will in a few days open Mountain Park for the summer.

New York.—Specifications for fitting the Forty-second street, Tenth avenue and Boulevard surface railway lines with the underground electric system have been completed and bids for the work will be advertised within the next two weeks. It is probable that within a year all the horse and cable lines operated by the Third Avenue company will be turned into underground trolley roads. The main line in Third Avenue will, however, be the last to be so equipped. The company owns between seventy and eighty miles of tracks, and the cost of changing the power and providing new rolling stock will be at least \$5,000,000. Work on the power house which it is proposed to build at Kingsbridge Road and 216th street will be begun next month.

North Tonawanda, N. Y.—The Lockport branch of the Erie Railroad has been leased for a term of years by the Buffalo & Niagara Falls Electric Railroad Company and will be converted into an electric line.

Ottumwa, Ia.—The plant of the Ottumwa Electric Railway & Power Company was sold on the 29th ult. at public auction by the master in chancery, the purchaser being E. E. McElroy, trustee for the bondholders. The price paid was \$190,000. The plant is said to be worth \$500,000.

Plainfield, N. J.—After two years of agitation, a trolley franchise has been granted in Bound Brook, and the last link in the system of the Brunswick Traction Company is completed. The ordinance allows connection to be made with the extension to Somerville and Raritan on the west, and with Lincoln, Dunellen and Plainfield on the east, and South Bound Brook and New Brunswick on the south.

Providence, R. I.—The question of putting the wires of the Narragansett Electric Lighting Company underground was discussed at a meeting of the joint special committee on underground wires a few evenings ago. Representatives of the lighting company were present. They stated that the cost would be about \$500,000 and that three years would be required to do the work, which involved about 16 miles of streets. It was thought probable that the telephone and telegraph companies would agree to use the same conduits for their wires. The committee said they would make every effort to bring about a satisfactory arrangement to all parties concerned.

Putnam, Conn.—The People's Tramway Company organized a few days ago at Danielson by electing officers and directors. The capital stock of the company is \$125,000. A survey of the route between Danielson and Putnam will be made at once.

Rockaway Beach, L. I.—The Nassau Company of Brooklyn proposes to build a roadway across Jamaica Bay which will contain besides the trolley tracks a bicycle path and driveway, if a majority of the residents of Rockaway Beach favor the plan. The Secretary of War has granted permission to cross the bay on this condition.

St. Cloud, Minn.—It is announced that the street railroad property in this city, which was bid in at a bondholders' foreclosure sale a few months ago by Jared How, has been sold to the Benton Power & Traction Company, a new corporation, of which C. M. Hertig of the Merchants' National Bank of St. Cloud is president. The present manager of the line, E. E. Clark, is to be retained by the new company.

St. Louis.—The St. Louis, Clayton & Creve Coeur Lake Railway, supposed to be controlled by the Lindell Company, has secured a franchise from the St. Louis county court covering about 25 miles of extensions. Among other things it will give a line from Clayton to Kirkwood, a line from St. Louis to Creve Coeur Lake, and an extension to the village of Des Peres.—Under a court decision the receivership of the People's Railroad Company of this city has passed from Charles Green to F. B. Brownell, president of the Brownell Car Company, who has filed a bond for \$100,000 and taken charge of the property.

Washington, D. C.—The Capital Traction Company on the 4th inst. began the operation of its Pennsylvania avenue and 14th street lines by electricity from its new power house. The service supplied by the Potomac Electric Power Company has been discontinued.

Waukegan, Ill.—It is announced that the Bluff City Electric Railway has been sold to W. T. Ball, an Indiana capitalist. The road will be completed from this city to Highland Park. Then its name is to be changed and it will be extended to Evanston, there to make some connection for Chicago. It is expected to be extended north from here to meet the Milwaukee, Racine & Kenosha line. A. C. Frost and F. O. Rushing, both of Chicago, will be respectively treasurer and general manager of the new company.

Wilkes-Barre, Pa.—The Wilkes-Barre & Northern Railroad Company's line between this city and Harvey's Lake is to be equipped with electricity at a cost of \$50,000.

LIGHTING PLANTS.

Fayette, Ala.—An electric light plant is among the probabilities and would be welcomed by the people.

Hyannis, Mass.—N. O. Bond has started an active canvass in the interest of his proposed electric lighting company. He expects to be soon able to form a company with a capital stock of \$7,000. He has subscriptions now amounting to \$3,600.

Kershaw, S. C.—Mayor Floyd of this city is very desirous of having waterworks and an electric light plant established, and the city council will act on the question at once.

Columbus, O.—Under an act passed in the closing days of the last Legislature, municipalities are authorized to lease waterworks and electric light plants for a term of years with the privilege of purchasing them at the expiration of the lease. The city of Cuyahoga Falls has just contracted with a Chicago company for a \$70,000 plant under these conditions.

Sacramento, Cal.—The city trustees have appointed a committee of their body, composed of Trustees Tebbets, Devine and Paine, to devise ways and means for securing a municipal electric lighting plant.

Shellsburg, Ia.—The people of this place are agitating the question of electric lights and a public meeting has been called to formulate a plan of action.

Smithsburg, Md.—The propositions for waterworks and electric lights were carried at the election held here on the 2d inst.

St. Louis.—The "Star" says: "One of the proudest boasts of St. Louisans is that within its limits is situated the largest and most complete electric plant in the world. It is the Missouri Edison Light & Power Company. This immense concern is the result of the combination of the Edison Illuminating Company and the Missouri Electric Light & Power Company, both of them establishments of the first class. The aggregate power of the lights furnished from the power houses of the company approximates 12,000,000 candle power. Besides the lights this company furnishes power for innumerable electric fans, bells and other modern inventions. The business, manufacturing, and best residence portions of the city are supplied with light and power by the company."

Two Harbors, Minn.—The council proposes to borrow \$4,000 for the purpose of putting in an electric light plant.

MANUFACTURING, ETC.

Albany, N. Y.—A contract aggregating \$23,000 has been awarded by the State Board of Capitol Commissioners to the E. G. Bernard Company of Troy for electric wiring at the State Capitol. The E. G. Bernard Company has filled many contracts in a most satisfactory manner, not the least valuable of which is that furnished in December last for a vessel which now has made its reputation, viz., the *Mangrove*, whose electrical facilities were made use of by the U. S. Government in the investigations at the wreck of the battleship *Maine* in the harbor of Havana.

Elbridge, N. Y.—A new company for the manufacture of dynamos and electrical supplies has been formed and will be known as the Elbridge Electrical Apparatus Company. The new company will make a specialty of "the Midget," a small dynamo used in schools as a demonstrating apparatus. The company has recently placed on the market a new self-playing piano or organ attachment, "The Maestro," invented and patented by Lewis B. Doman, one of the firm.

Evansville, Ind.—The Evansville Gas & Electric Light Company has been granted a 25-year franchise to supply heat and power. They agree to pay the city 2 per cent. annually of the gross receipts from the sale of electricity for these purposes.

New Orleans.—The corner-stone of the central power station of the drainage system was laid with appropriate ceremonies on the 30th ult. This is the beginning of the grandest piece of work ever attempted by the city. Electricity has been adopted for operating the plant.

Ithaca, N. Y.—The "Journal" says: "An improved electrical apparatus has just been received for temporary use at the College of Agriculture, which it is expected will revolutionize methods of testing soil moisture. By means of this machine it is hoped that finally scientific men will be able to determine exactly the best methods of cultivation of soil which is practically synonymous with the best method of retaining moisture in the soil. With it, it will be possible to determine exactly whether rolling or cultivating or mulching or other method does the farmer's crops the most good."

Pittsburg.—An additional order for about four miles of submarine cables has been received by the Standard Underground Cable Company. It is for use in one harbor on the Atlantic coast and another in the Gulf of Mexico.

Washington, D. C.—The Naval Appropriation bill contains the following items: For addition to electric light system at the Brooklyn Navy Yard, \$15,000; electric plant at the League Island Navy Yard, \$5,500; for improvement of electric plant at Washington Navy Yard, \$16,000; for enlargement of electric plant, etc., at the Norfolk Navy Yard, \$20,000; for electric light and power plant at Port Royal Naval Station, \$20,000; for extension of electric system at the Mare Island Navy Yard, \$15,000; for electric light plant at Puget Sound Naval Station, \$9,800; for electric lighting, etc., at the Naval Academy at Annapolis, \$90,000, and for the installation of electric plants in gunboats numbered 10, 11, 12 and 13, \$40,000.

COMPANY MATTERS.

Yardley, Pa.—The Provident Electric Light & Power Company of this place has been reorganized, and is now named the People's Electric Light & Power Plant. E. W. Maloney has been retained as general manager.

Aspinwall, Pa.—The Aspinwall Electric Light Company has been dissolved by order of the court in response to a petition of the stockholders.

WAR WORK OF THE ELECTRICIANS.

J. H. Murphy of the Indianapolis Electric Company is organizing a corps of electricians for the Government.

The work of laying the submarine mines in the harbor of New York is being rushed. The work is under the charge of Major John G. D. Knight, of the Engineer Corps, at Willet's Point, and Lieutenant Robert McGregor, at Sandy Hook. They have a large force of men at work.

The office forces of the various electrical manufacturing works have been reduced more or less to supply the Government with men experienced in electrical work. The General Electric works at Schenectady have furnished about twenty-five men from the office force for service under the Government.

Henry J. Carr, an electrical expert connected with the Navy Department, has been detailed to inspect the various Baltimore fortifications with a view of perfecting their electrical connections.

Capt. Eugene Griffin has, it is stated, instructed Manager E. W. Mullen of the General Electric Company at Philadelphia to recruit a special battalion of engineers to comprise draughtsmen, artisans, electricians and skilled mechanics. Seven hundred men will be required, and there are already over 300 applicants for enlistment. A recruiting office has been opened at 509 Arch street, Philadelphia. The men will be assigned by the War Department to mining and engineering operations in the harbors.

A recruiting office has been opened in the Equitable Building at Baltimore for men skilled in electrical and mechanical work to form two companies to become a part of the First United States Engineer Corps. The recruiting office is in charge of Dr. Louis Duncan, W. E. Molinar and James E. Hughes. The two companies to be organized in Baltimore become part of a regiment composed of twelve companies, of which Boston will supply two companies and New York eight companies. This regiment, with two similar regiments made up from other cities, will form the First United States Volunteer Engineer Corps.

The Edison Electric Company at New Orleans supplied the Government with a number of electricians

from its regular force for service at Forts Jackson and St. Philip. As the experts were leaving the company's office the manager told them they were now becoming Government men, but they would nevertheless always remain Edison men, and he expected such a report of them as would warrant the dual honor which had come to them. Their answer was so enthusiastic that no one could doubt the loyal service they will perform when called upon.

PERSONAL AND MISCELLANEA.

Electricity is used to operate a newly-invented type-writer, in which the keyboard may be separated from the machine and used to operate several machines, the keys closing circuits connected to magnets which operate the type levers.

The Baltimore "American" draws this sage deduction from the fact that wireless telegraphy is being eagerly investigated: "The electric wire is something like Spain—it has so abused its privileges and presumed on its importance that now it finds the general hand against it, trying to hasten the day when it shall be banished from the face of the earth."

A Lexington, Ky., item in the Louisville "Times" states that Charles H. Stoll, for nine years president of the Lexington Associated Companies, consisting of the Electric Street Railway, Hercules Ice Plant, Central Electric Light Works and several land companies, will resign to go to New York City to practise law.

A Holyoke, Mass., man, Robert Krueder, had charge of the construction of the electric lighting plant in the city of Manila which has been taken by Commodore Dewey's fleet. Mr. Krueder spent five years in Manila, and says it is a city well worth taking.

By means of a recently designed magnetic base the incandescent electric lamp can be practically used in boiler shops and machine plants where a bright light in an out-of-the-way place is frequently demanded. The "Manufacturer's Gazette" says the plan consists of an ordinary lamp with an Edison or other base, so that any style of lamp may be utilized, and in case of breakage or burning out can readily be replaced. The lamp holder is mounted on a stand about 24 inches high and 2 inches in diameter, the holder, which is of brass, inclosing a horseshoe electro-magnet, the poles of which are outside the bottom of the holder, and the magnet winding being in series with the filament, the lighting current passes through it, thus energizing the magnet. The poles of the electro-magnet are made of sufficiently hard iron to retain its magnetism in a measure, thus insuring the safety of the lamp should the current accidentally be shut off for a moment.

RECENT COMPANY ELECTIONS.

Brush Electric Company, Rochester, N. Y.—Directors: George W. Archer, G. C. Hollister, Frederick C. Oak, J. N. Beckley, William Runkle, G. A. Hollister, A. H. Harrie, H. L. Brewster and J. Lee Judson.

Crescent City Railroad Company, New Orleans—President, J. C. Denis; secretary, R. M. Ford; general manager, C. D. Wyman; directors: A. B. Wheeler, F. T. Howard, A. J. La Place, C. D. Wyman, Albert Baldwin, J. C. Denis and R. M. Walmsley.

Dover Electric Light Company, Dover, N. J.—President, D. S. Allen; secretary, I. W. Searing; treasurer, L. D. Schwarz; directors: D. S. Allen, I. W. Searing, L. D. Schwarz, George McCracken, C. E. Olark, Alex. Kanoune and David Young.

People's Tramway Company, Danielson, Conn.—President, F. A. Jacobs; treasurer, Van Wyck Rossiter; secretary, R. L. Warner; directors: C. A. Potter of Brooklyn, William P. Kelley of Danville, O. W. Bowen and F. A. Jacobs of Danielson, A. B. Sprague of Moosup, R. L. Warner of Boston, Van W. Rossiter of New York.

Penn Yan, Keuka Park & Branchport Electric Railway Company, Yates, N. Y.—President, W. S. Reed; first vice president, O. L. V. Tylee; second vice-president, H. R. Sill; secretary, F. H. Vele; superintendent, C. L. V. Tylee; treasurer, W. H. Tylee; auditor, F. H. Vele; directors: the officers and Edward Donahue, C. E. Dresser, D. W. Rugg and G. E. Tylee.

Putnam & Thompson Street Railway Company, Putnam, Conn.—President, George H. Nichols; secretary, R. T. Warner; treasurer, Van Wyck Rossiter; directors: R. T. Warner of Boston, Van Wyck Rossiter of New York, Geo. H. Nichols, William Vaughan of Providence, L. H. Fuller, George A. Hammond, Prescott Bartlett of Putnam.

Rochester Gas & Electric Light Company, Rochester, N. Y.—Directors: J. Lee Judson, William Runkle, Frederick Cook, George W. Archer, Albert H. Harris, Granger A. Hollister, Walter S. Johnson, Harry G. Runkle, R. A. C. Smith, George C. Hollister, Harry L. Brewster, John N. Beckley and George A. Redman.

Rome City Street Railway Company, Rome, N. Y.—Directors: John S. Wardwell, A. C. Kessinger, W. R. Huntington, James H. Searles, Dr. W. L. Kinsley, Hon. John D. McMahon and W. P. Rayland.

South Chicago City Railway Company, Chicago—President, D. F. Cameron; vice-president, D. M. Cummings; secretary and treasurer, O. S. Gaither; directors to serve three years: D. F. Cameron and C. F. Corning.

The People's Electric Light Company, Flint, Mich.—President, F. P. Smith; vice-president, A. H. Gillies; treasurer, Romain Putnam; secretary, A. G. Bishop; directors: the officers and George E. Taylor, J. J. Hurley, W. A. Patterson, C. H. W. Conover and Alex. McFarlan.

The Bolton Falls Electric Company, Waterbury, Vt.—President, G. E. Moody; vice-president, C. O. Warren; treasurer, C. L. McMahon; manager, G. H. Almon; clerk, C. D. Robinson; directors: G. E. Moody, C. L. McMahon, C. O. Warren, G. H. Almon and G. W. Randall.

Westerly Gas & Electric Light Company, Westerly, R. I.—Directors: Edwin Babcock, Peleg Clark, A. L. Chester, George H. Utter and William Segar.

Woonsocket Electric Machine & Power Company, Woonsocket, R. I.—Directors: Dr. A. W. Buckland, Edgar K. Ray, Willard Kent, John J. Heffernan, Charles H. Gorton, George R. Smith, Henry F. Sayles, George Batchelor and Levi C. Lincoln.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

COMMERCIAL PARAGRAPHS.

The De Vries Patent Water-Tube Feed-Water Heater and Purifier.

The De Vries Water-Tube Feed-Water Heater and Purifier, shown in the accompanying cut, contains advantages found in no other. The inventor has had considerable experience in this line and has combined the best qualities of other makes with several entirely new and valuable features.

The method of circulation is such that the feed-water is divided into many small columns and flows through an entire bank of tubes at the same time. This in itself is a great advantage over those heaters in which the water is forced through a coil or from a single tube to another, resulting in considerable loss of power and obtaining the result by friction rather than by heating surface.

The settling chamber is large, and concave in form, so that impurities settle to the bottom from where they may be blown off while pure hot water proceeds to the boiler.

U shaped tubes are used, both ends of each being expanded into the tube sheet. Experience has demonstrated this to be the most practical provision for contraction and expansion.

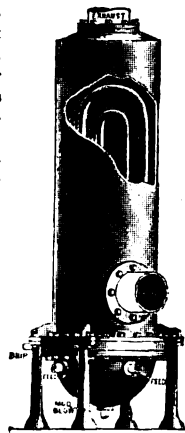
This is the only heater that can be thoroughly inspected, cleaned, and, if necessary, taken apart for repairing without disconnecting the exhaust pipes. As these are the main connections this feature will be appreciated by those who have had experience with the older types of heaters.

The castings used are extra heavy, especially the tube sheet, which, being subjected to the greatest strains, is made particularly thick and strong.

The heater is sold by F. L. Patterson, 135 Liberty street, New York, who will be pleased to give further particulars and prices upon application.

We would call our readers' attention to an attractive advertisement, which appears in this issue, of Henry G. Allen & Co., the well-known publishers, located at 150 Fifth avenue, New York. This concern is offering sets of the Encyclopedia Britannica at an extremely low price and on easy terms. In order to enable them to make this price, the books have been printed upon high grade but slightly thinner paper than is used in their single volume edition. This enables the publishers to bind two volumes in one without making the books too cumbersome to handle (they being only 2½ to 3 inches in thickness), and thus a material saving in the cost of binding is effected. Including the American Supplement this work is extremely elaborate, containing in the neighborhood of 25,000 pages, over 10,000 illustrations and 700 maps. As the price of this valuable work with the supplement, bound in silk cloth, is but \$30, payable at the rate of \$2 a month, persons having occasion to use an encyclopedia should certainly avail themselves of the opportunity offered.

The American Carbon Company of Noblesville, Ind., the well-known anti-trust concern that has made frequent inroads on the business of the Trust, has lately closed a deal for 500,000 carbons at Washington, D. C. The company claims to be turning out as many carbons as all the other independent companies combined, and the excep-



tionally high quality of their product is evidently appreciated by the trade as shown in the fact that they are closing large contracts daily.

The firm of Stone & Webster, Boston, announce that they have made arrangements with Prof. S. Homer Woodbridge by which his business of heating, ventilating and sanitary engineering will hereafter be intimately associated with their own electrical engineering work.

INCORPORATIONS.

The Chagrin Falls & Eastern Electric Railroad Company, Cleveland, O. Capital stock, \$300,000.

The Standard Railway Equipment Company, East St. Louis. Capital stock, \$50,000. Incorporators: P. H. Murphy, C. F. Lodeberg and W. A. Rodenberg.

The Citizens' Lighting Company, Atlantic City, N. J. Capital stock, \$150,000. Incorporators: John H. Rothermel and J. H. Rothermel, of Reading, Pa., and Rodman Carson, of Atlantic City.

The Fast Greenwich Electric Light Company, East Greenwich, R. I.—to produce, sell, distribute, lease and use electricity for lighting purposes. Capital stock, \$100,000.

The Edmunds Electrical Construction Company, Fort Wayne, Ind. Capital stock, \$2,000. Incorporators: H. M. Edmunds, Chicago; F. W. Edmunds and Harry Bash, Fort Wayne.

The Barnabro Electric Light Company, Barnabro, Pa. Capital stock, \$1,000. Directors: Thomas Barnes, George W. Ziegler, Philipsburg; J. T. Shuger, Chester Hill; John Barnes, Barnabro; Alfred Tucker, Philadelphia.

The Gloucester County Electric Company has filed articles of incorporation with the county clerk at Woodbury, N. J. The incorporators are: Thomas M. Latta and M. K. Trichler, Philadelphia; John Mayhew, Woodbury Heights; Blair Smith, Wendenah; Isaac F. Imhoff, Glassboro; Rudolph McFarland, Monroeville; D. W. Green and Bingham Hood, Pitman Grove, and David O. Watkins, Woodbury. The new company has purchased the plant formerly belonging to the Pitman Grove & Glassboro Company.

The St. Cloud Water Power Company, St. Cloud, Minn.—to build and improve dams, canals, etc., and build and operate railways and telegraph and telephone lines in the State of Minnesota. Capital stock \$25,000, and limit of indebtedness \$150,000. Incorporators and first board of directors: Richard B. Fisher, Clinton B. Wright and William Checkley Shaw, all of Baltimore, Md.; Edward E. Clarke and David T. Calhoun, of St. Cloud.

The Buffalo & Lockport Railway Company, Buffalo, N. Y.—to operate a street surface railroad from Buffalo to Lockport. Capital stock, \$1,000,000. Directors: Burt Van Horn, H. J. Pierce, R. L. Fryer and G. H. Dunbar, of Buffalo; J. A. Merritt, S. Curt Lewis and F. M. Ashley, of Lockport; F. A. Dudley and W. Caryl Ely, of Niagara Falls.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 3, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

603,288. Electric-Arc Lamp. Timothy H. Pettingill, Amsterdam, N. Y. Filed Sept. 7, 1897.

603,383. Electric-Arc Lamp. Alfred W. Knutson, Galesburg, Ill. Filed April 30, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

603,515. Electrical Apparatus. William Stanley, Pittsfield, Mass., assignor to the Stanley Instrument Company of Massachusetts. Filed Jan. 28, 1897.

603,521. Electric Dental-Engine Controller. James J. Coachman, Rio Janeiro, Brazil. Filed Aug. 21, 1897.

603,604. Electric Conveying System. Alvaro S. Krotz, Springfield, Ohio, assignor to Oliver S. Kelly, same place. Filed Dec. 2, 1897.

SIGNALS AND SIGNALING APPARATUS.

603,349. Electric Signal System. Louis C. Werner, Broad Brook, Conn. Filed June 12, 1897.

603,300. Electric Signal System. Louis C. Werner, Broad Brook, Conn. Filed June 17, 1897.

MISCELLANEOUS.

603,263. Process of and Apparatus for Electrolytic Tanning. Edward Davis, Philadelphia, Pa., and Horace R. Mustard, Smyrna, Del. Filed July 27, 1896.

603,270. Automatic Electric Fire Alarm. Walter E. Frost, Lewiston, Me., assignor to Orland S. Ham, same place. Filed June 30, 1897.

603,286. Electroplating Apparatus. Louis Pothoff, Flushing, N. Y. Filed April 22, 1897.

603,331. Electrical Attachment for Gas-Lights. Franklin L. Kellner and George S. Barrows, Philadelphia, Pa., assignors to the Welsbach Light Company, Gloucester City, N. J. Filed Nov. 22, 1897.

603,451. Electric Programme-Clock. James O. Lyman, Waterbury, Conn. Filed April 25, 1897.

603,499. Art of Making Plates for Electric-Battery Purposes. Alfred C. Croftan, Chicago, Ill. Filed Feb. 5, 1897.

WANTED FOR THE UNITED STATES NAVY.—Qualified men for the ratings of ELECTRICIAN. Applicants must be capable of performing all duties pertaining to the care, preservation, and manipulation of a ship's electric lighting plant and its appurtenances, together with all other electrical appliances; they must also be physically qualified. First enlistment is made in the rating of Electrician, second class, (\$35 per month), with possibility of future advancement to Electrician, first class, (\$40 per month), and Chief Electrician, (\$50 per month). In addition to the pay stated, there is a ration allowance of 30 cents per day. Enlistments in this rating are made only at the Navy Yards, Brooklyn, N. Y.; Boston, Mass., and Mare Island, Cal.

TELEPHONE AND TELEGRAPH.

Telegraphy in War.

The Washington correspondent of the *Evening Post* offers some suggestions which it would be well for the Government to heed in the equipment of our naval vessels and land forces. "The battle of Manila," he says, "offers an illustration of the wisdom of having experts in telegraphy and electrical engineering attached to every army or fleet. It ought not to have been necessary to keep the world so long in ignorance of what Commodore Dewey had actually accomplished. If the electrical end of his establishment had been cared for as scrupulously as its strictly fighting end, he could have made his victory even more complete in its moral effect by showing the Spaniards the hopelessness of a war against so ingenious a people as ours. . . . It should be the care of every commander of an army or a fleet to have with him a small corps of men who not only understand the working of the telegraph key and read messages by sound, but are shrewd enough to do a thousand things in the way of repairing and emergency work which may be called for when no outside aid can be procured. These men should understand splicing wire and cable in any condition and amid any surroundings. They should be of trained ingenuity in running down and locating breaks in the connection. They should have enough sobriety of judgment to be able to play the censor if necessary on despatches put into their hands to send. They should be telegraphic geographers, as well as everything else, having at their fingers' ends the directions and junctions of telegraph lines all over the earth, for it sometimes becomes of the very first importance to send a message to the other side of the enemy's country without actually passing through it.

"The use of electricity in warfare has grown very much within the last ten or fifteen years, but the war between Spain and the United States promises to do more to illustrate the possibility of this branch of science than has been dreamed of heretofore. Telegraphy and telephony will both be called into play to do what has formerly been done by wig-wag signals, sending dispatches by courier, etc. Telegraph wire has been reduced so in weight that a man can transport two miles of insulated double conductor as rapidly as a column of cavalry can move. This includes the weight of the reel for paying out the wire, as well as of the wire itself. The flying field telegraph and telephone makes a kit weighing not to exceed thirteen pounds, and this includes a diminutive Morse key and buzzer so that messages can be sent simultaneously from both instruments."

The annual report of the New England Telephone & Telegraph Company for the year 1897 shows: Revenue—Exchange service, \$2,397,735; toll service, \$555,912; private line, \$67,738; messenger, \$37,805; real estate, \$1,000; interest, \$16,132; miscellaneous, \$19,767; total, \$3,097,089; increase over 1896, \$316,437. Expenses—General and taxes, \$388,370; operating, \$491,572; maintenance, \$1,091,607; private line, \$10,047; rental and royalty, \$223,795; messenger, \$34,044; real estate, \$810; interest, \$192,489; total, \$2,130,664; increase over 1896, \$260,947. Net revenue, \$660,425; dividends, \$569,543; surplus, \$90,882, or \$5,873 less than last year. The report states that the addition to the number of exchange subscribers during the past year was by far the largest recorded in any year since the company began business. The expenditure for new construction and properties purchased during the year amounted to \$464,765, of which \$182,771 was for exchange aerial construction, \$129,548 for underground work, \$51,176 for equipment, and \$98,268 for toll lines. The company acquired during the year the property of the Vermont Telephone & Telegraph Company, operating in Montpelier and vicinity.

"News of the fighting in Manila, on the other side of the earth, travels more than 14,000 miles, over a dozen or more cables and three or more overland wires, before it gets to this city," says the *New York Sun* of the 3d inst. "Very few persons, among the thousands who watch the bulletin boards these days stop to think when a Manila dispatch is posted that the message was repeated over and over again as it was sent from cable office to cable office in the long journey from the Philippine port to the American shore. It traveled across seas, gulfs, bays and straits, mountains, valleys and plains. But yesterday the news that Commodore Dewey was ready to bombard Manila was known in this city in thirty-five minutes, in actual time, after the British operator at Manila opened his key. The cables were rushing things."

A special dispatch to the *St. Paul Dispatch* from Chamberlain, S. D., states that representatives of a telephone company which now has lines connecting all the principal towns in the eastern portion of South Dakota are visiting that section of the State to arrange the preliminaries for extending the line to the Missouri river. The line now reaches Madison, and it is the purpose of the company to extend it to Woonsocket, Mitchell, Chamberlain, Yankton, Huron and Pierre, giving these towns telephone connec-

tion with St. Paul, Minneapolis and other outside points, as well as the chief towns of South Dakota.

At the annual meeting of the stockholders of the New England Telephone & Telegraph Company, held in New York on the 2d inst., the following directors were elected: Charles F. Ayer, John H. Cahill, Benjamin C. Dean, William H. Elliot, John E. Hudson, Henry S. Hyde, David B. Parker, Moses G. Parker, Stephen Salisbury, Thomas Sherwin, Winfield S. Hutchinson and Thomas B. Bailey. The old officers were re-elected.

Ten thousand shares of Drawbaugh Telephone and Electrical Appliance Company stock were sold last week in Harrisburg, Pa., at trustees' sale. Daniel Drawbaugh, the inventor and prime mover in the company, was the purchaser at his bid of \$11,600. It is understood that a pool is being formed to get a corner on this stock. Drawbaugh is at work on a device which he claims will be valuable in warfare and mining.

T. B. Dixon, of Henderson, Ky., who claims to have invented a method of sending four messages on one wire at the same time in a way that is a decided improvement on the present quadruplex, has been permitted to put his instruments in the office of the Postal Telegraph Company at Buffalo, where a test will be made with New York over the wires of the company.

The *Journal of Commerce* says: "A prominent firm in the Argentine trade says that as far as power-houses and electrical railroad material is concerned manufacturers in this country can count on the bulk of the business of the Argentine Republic. They should now try and secure a share of the telegraph supplies business, all of which is going to England at prices on many articles in excess of that of the Americans."

The Stromberg Company having brought suit at Webster City, Ia., against the E. H. Mario Telephone Company on an attachment for \$2,000, the latter company has entered a counter claim of \$500 on the attachment bond and an additional claim of \$1,000 for damages.

There has just been installed in the White House at Washington the most complete telegraphic communication not only with every community of the United States but with well nigh every square mile of territory in the civilized world. This can be placed in circuit with our land forces everywhere, and if need be with naval vessels far out at sea.

The Electrical Committee of Councils in Philadelphia, to whom was presented the Drawbaugh Telephone Company's revised ordinance, has referred it to a sub-committee consisting of Messrs. Hetzel, Klemmer, Upperman, F. Stevens and McMullin.

The Omaha *Bee's* Gering, Neb., correspondent states that thirty-five shares of stock have been subscribed for a telephone line from Gering to Kimball by way of Harrisburg, and that considerable more stock will be subscribed at Kimball and Harrisburg.

The druggists of Washington, D. C., have become so dissatisfied with the methods of the local Bell company that they have ordered the "dime in the slot" phones removed from their stores.

Under the new tariff now in operation in Chili, S. A., telephonic and telegraphic instruments, insulators, iron or steel posts and all other special accessories for telegraphs and telephones, with the exception of wooden cross pieces for the posts, are admitted free of duty.

The New State Telephone Company has secured a 30-year franchise from the village council of Inlay City, Mich.

The Board of Education at Los Angeles, Cal., has ordered telephones put in in all of the school buildings.

A telegraph line is to be constructed at once from Vancouver to Dawson City via Skaguay, Dyer and Wrangel.

New Companies Incorporated.

The Eastern Illinois Telephone Company, Kankakee, has certified to an increase of capital stock from \$15,000 to \$25,000.

The Kings Mountain Telephone Company, Kings Mountain, N. C. Capital stock, \$1,000. Incorporators: P. S. Baker, F. Dilling, C. E. Nesler, R. S. Plank and J. S. Manning.

The Freehold Telephone & Telegraph Company, Freehold, N. J.—to conduct a telephone business in and adjacent to Freehold and to connect with other lines. Capital stock, \$10,000. Incorporators: Frederick L. Benzon and R. J. Emory, Jersey City; S. A. Boyd, Brooklyn, N. Y.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: *ert.* indh., certificate of indebtedness; *coll.*, collateral; *cons.*, consolidated; *const.*, construction; *conv.*, convertible; *com.*, common; *deb.*, debentures; *exten.*, extension; *gen.*, general; *g.*, gold; *guar.*, guaranteed; *inc.*, income; *imp.*, improvement; *pd.*, paid; *prfd.*, preferred; *mtg.*, mortgage; *tr.*, trust; *A.*, annually; *S.*, semi-annually; *Q.*, quarterly; *A. & O.*, Apr. and Oct.; *F. & A.*, Feb. and Aug.; *M. & S.*, May and Sept.; *J. & D.*, July and Dec.; *J. & J.*, Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Albany, N. Y.—May 10:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1% Q., Feb. '98.	145	147
Troy City Railway Co.	100	2,000,000	2,000,000 1% Q., Dec. 10, '97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000		
Allentown, Pa.—May 10:					
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000		15
Bridgeport, Conn.—May 10:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1% Aug., '97.	45	60
Baltimore, Md.—May 10:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5% S., July 2, '97.	71	72
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000 2% S., Jan. 15, '98.	23 1/2	24 1/2
Central Ry. Co. of Baltimore City	50	800,000	800,000 6% A. Dec., 1897.	80	82 1/2
Boston, Mass.—May 10:					
New England Street Ry.	25	5,000,000	1,081,925 1% Q., Jan. 15, '97.		
North Shore Traction Co.	100	4,000,000	4,000,000	10	13
North Shore Traction Co. pfd.	100	2,000,000	2,000,000 6% S., A. & O.	67	72
West End Street Ry. Co.	50	10,000,000	9,085,000 4% S., Oct., '97.	81 1/2	82
West End Street Ry. Co. 8% pfd.	50	6,400,000	6,400,000 4% S., Oct. 1, '97.	103	103 1/2
Boston Elevated R. R.	100	10,000,000		61	
Brooklyn, N. Y.—May 10:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400 2% Feb. 1, 1898.	185	195
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	40 1/2	40 1/2
Brooklyn Heights Railroad	100	200,000	200,000		
Brooklyn City RR. guar.	100	12,000,000	12,000,000 2% Q., Jan., '98.	199	261
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000		
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000 1% Oct. 1, '97.	140	
Kings County Elevated	100	4,750,000	4,750,000		
Kings County Traction Co.	100	4,500,000	4,500,000 1% July 28, '97	45	47
Nassau Electric Railroad	100	6,000,000	6,000,000		37 1/2
Atlantic Avenue Railroad	50	2,000,000	2,000,000		
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000	74	80
Buffalo, N. Y.—May 10:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	58	60
Buffalo Railway Co.	100	6,000,000	5,370,500 1% Q. Dec., '97.	78	80
Columbus, O.—May 10:					
Columbus Street Railroad	100	3,000,000	3,000,000 1% Q., Feb., '98.	45	46
Columbus Central Street Railroad	100	1,500,000	1,500,000		
Charleston, S. C.—May 10:					
Charleston City Ry. Co.	50	100,000	100,000 3% S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000		
Chicago, Ill.—May 10:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 3% Q., Dec. 31, '97.	234	235
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800		
Lake Street Elevated RR.	100	10,000,000	10,000,000	13 1/2	18 1/2
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000		8 1/2
Met. West Side El. const. stik.	100	15,000,000	2,500,000		
North Chicago Street RR.	100	10,000,000	6,600,000 3% Q., Jan., '98.	199 1/2	201
North Chicago City RR.	100	500,000	249,900		
South Chicago City Railway	100	2,000,000	1,603,200		
West Chicago St. R. R. Co.	100	20,000,000	13,189,000 1% Q., Feb. '98.	92 1/2	92 3/4
Chicago West Div. Ry. guar.	100	1,500,000	624,900 35%		
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000 5% S.		
Cincinnati, Ohio.—May 10:					
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000		20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000 2% S., Feb., '98.		75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	23	25
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000 1% Q., Jan., '98.	112 1/2	113
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1% Q., Jan., '98.		
Cleveland, Ohio.—May 10:					
Akron, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000 1/4% Jan., '98.	39	40
Cleveland City Ry.	100	8,000,000	7,600,000 1/4% Q., Oct., '97.	55	56
Cleveland Electric Ry.	100	12,000,000	12,000,000 1/4% Q., Oct., '97.	61 1/2	62
Detroit, Mich.—May 10:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100 1/2	
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000 5% July, '96.	175	
Rapid Railway Co.	100	250,000	250,000		100
Detroit Electric Railway	100	1,000,000	1,000,000		
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton, O.—May 10:					
City Railway Co.	100	1,500,000	1,470,600 1 1/4% Q., Jan. 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000 1 1/2% Q., Jan. 1, '98.	140	145
People's Street Railway	100	1,100,000		100	

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$250,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 35% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$250,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming the bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Hartford Conn.—May 10:					
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000 3% S., Jan., '98.	140	
Hartford & West Hartford RR.	100	1,000,000	247,000		
Holyoke Mass.—May 10:					
Holyoke Street Ry. Co.	100	400,000	400,000 8 1/2% A., Jan., '98.	200	205
Hoboken, N. J.—May 10:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8%, 1892.	70	
Indianapolis, Ind.—May 10:					
Citizens' Passenger Ry.		5,000,000	5,000,000	24	25
Lancaster, Pa.—May 10:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000		
Lancaster & Col. Electric Ry.			87,500		
West End Street Railway					
Louisville, Ky.—May 10:					
Louisville Ry.	100	4,000,000	3,500,000 1 1/4% Q., Oct., '97.	80	85
Louisville Ry.	100	2,500,000	2,500,000 2 1/2% S., Oct. 1, '97.	87	94
Minneapolis, Minn.—May 10:					
Twin City Rapid Transit	100	17,000,000	15,010,000	14	20
Twin City Rapid Transit		8,000,000	1,714,200 1 3/4% Jan., '98.		100
Montreal, Canada.—May 10:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8% S., M. & N.	253	255
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1 3/4% S., J. & J.	95	95 1/2
Memphis, Tenn.—May 10:					
Memphis Street Railway Co.	100	500,000	500,000	15	
New Haven, Conn.—May 10:					
Fair Haven & Westville RR.	25	1,500,000	900,000 4% S., Sept. '97.	60	
New Haven Street Railway Co.	100	1,250,000	1,000,000 2 1/2% A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000		
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—May 10:					
Canal & Claiborne RR. Co.	40	240,000	240,000 4% S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1 1/2% Q., Jan., '98.	123 1/2	126
New Orleans Traction Co.	100	5,000,000	5,000,000	1 1/2	8
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	6	10
Crescent City RR.	100	2,000,000	2,000,000 3% S., Jan., '98.		30
New Or. City & Lake RR.	100	2,000,000	2,000,000 4% S., Jan., '98.	81	88
Orleans Railroad	50	500,000	185,000 1 1/2% S., June, '94.	16	17
St. Charles Street Railway	50	1,000,000	1,000,000 1 1/2% S., Jan., '98.	53 1/2	54 1/2
New York—May 10:					
Central Crostown RR.	100	600,000	600,000 2 1/2% Q., July, '97.	130	
Christopher & 10th Sts. RR. guar.	100	650,000	650,000 2% Q., Jan., '98.	154	164
Dry Dock, E. Broadway & Battery RR.	100	1,200,000	1,200,000 1 1/2% Q., Feb., '98.	175	195
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000 1 1/4% Q., Jan., '98.	148	149
Bleecker St. & Fulton Ry. Ry. guar.	100	900,000	900,000 3% A., July, '97.	32	34
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2 1/2% Q., Oct., '97.	205	212
Gen. Park N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2 1/4% Q., Jan., '98.	177	185
Eighth Avenue RR.	100	1,000,000	1,000,000	310	325
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2% Q., Feb., '98.	820	860
Ninth Avenue RR.	100	800,000	800,000	192	194
Sixth Avenue RR.	100	2,000,000	2,000,000	200	210
Twenty-third St. R. R. Co. guar.	100	600,000	600,000 4 1/2% Q., Feb., '98.	810	
Second Avenue RR.	100	2,500,000	1,862,000 2% Q., Jan., '98.	165	170
Third Avenue RR.	100	12,000,000	10,000,000 2% Q., Feb., '98.	168	170
42d St., Manhattan & St. Nich. Av.	100	2,500,000	2,500,000	59	62
Union (Huckleberry) Ry.	100	2,000,000	2,000,000	175	200
Newark N. J.—May 10:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	46	47
Newark Passenger Ry.	100	6,000,000	6,000,000		
Rapid Transit Street Ry.	100	504,000	504,000 1 1/4% A.	180	190
Pittsburg, Pa.—May 10:					
Allegheny Traction Co.	50	500,000	500,000		45
Consolidated Traction Co. com.	50	15,000,000	15,000,000 2% S., Jan., '96.	163 1/2	
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000 3% S., May, '97.	45 1/2	46
Central Traction Co.	50	1,500,000	900,000		
Citizens' Traction Co.	50	8,000,000	3,000,000 6% A.		
Duquesne Traction Co.	50	8,000,000	3,000,000 6% A.		
Pittsburg Traction Co.	50	2,500,000	1,900,000 3% Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000 2 1/2% S., Jan., '98.		
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,839 2% Aug., '95.		
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	3,000,000 1% S., Jan., '96.	18 1/2	19
Pittsburg & West End Ry.	50	1,500,000	1,500,000 5% A., June 30, '97.		
Second Avenue Traction Co.	50	4,000,000	14,000,000		
Suburban Rapid Transit Co.	50	800,000	200,000		

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Crostown Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, For Pittsburg & Pitts'h Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 6% on \$3,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—May 10:							Boston, Mass.—May 10:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2 % Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2 % Q., Jan., '98.	260	262
Northampton, Mass.—May 10:							New York.—May 10:						
Northampton Street Ry.....	100	800,000	225,000	4 % A., Jan., '98.	165	175	*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1 1/2 % Q.	102	108
Omaha, Neb.—May 10:							Miscellaneous.—May 10:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Dist. Tel. (Phila.).....	25	400,000	.....	1 % Q., Feb. '98.	14	..
Paterson, N. J.—May 10:							Boston, Mass.—May 10:						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	Fort Wayne Electric Co.....	25	.....	.....	.....	..	..
Providence, R. I.—May 10:							Fort Wayne Elec. Co. T. Sec. Series A.						
United Traction & Electric Co.....	100	8,000,000	8,000,000	3/4 % Jan. '98.	59	62	.....	25	.....	.....	.....	..	..
Philadelphia.—May 10:							General Electric Co..... com.						
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	1,770,000	2 % Dec. '97.	14 1/2	..	.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	85 1/2	85 1/2
Hestonville, Man. & Fairmount.....	50	1,966,100	\$1,966,100 2 % July 15, '97.	42	45	..	.....	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	92	94
Hestonville, Man. & Fairmount.....	50	533,900	\$533,900 3 % S—Jan. 10, '98.	61 1/2	65	..	.....	100	10,000,000	.....	.....	..	..
Fairmount Pk. & Had. Pass. Ry.....	50	300,000	\$300,000 3 % Feb. 1, '98.	63	66	..	.....	100	10,000,000	.....	.....	..	..
Union Traction Co..... \$12 1/2 pd.	50	30,000,000	\$23,330,450	.....	15 1/2	16	.....	100	10,000,000	.....	.....	..	..
Electric Traction Co.....	50	500,000	\$297,920	.....	71 1/2	71 1/2	.....	100	10,000,000	.....	.....	..	..
Citizens' Passenger Ry.....	50	1,000,000	\$1,875,000 \$14 share A—Apr. 97	37 1/2	..	..	.....	100	10,000,000	.....	.....	..	..
Frankford & Southwark Pas. R.	50	1,000,000	.....	47	..	..	.....	100	10,000,000	.....	.....	..	..
Lehigh Avenue Ry. Co.....	25	1,000,000	.....	89	90 1/2	..	.....	100	10,000,000	.....	.....	..	..
Lombard & South Street Ry.....	25	1,000,000	.....	265	..	..	.....	100	10,000,000	.....	.....	..	..
Second & Third Streets Ry.....	50	10,000,000	\$6,000,000 3 % A., April, '97.	132 1/2	135	..	.....	100	10,000,000	.....	.....	..	..
People's Traction Co.....	50	1,500,000	\$572,800 \$5.25 share—1898.	132 1/2	135	..	.....	100	10,000,000	.....	.....	..	..
Germantown Passenger Ry.....	50	500,000	\$150,000 3 % Jan., 1898.	132	..	..	.....	100	10,000,000	.....	.....	..	..
Green & Coates Passenger Ry.....	50	1,500,000	\$740,000	.....	82 1/2	82 1/2	.....	100	10,000,000	.....	.....	..	..
People's Passenger Ry..... com.	25	750,000	\$277,402	.....	82 1/2	82 1/2	.....	100	10,000,000	.....	.....	..	..
People's Passenger Ry..... pfd.	50	30,000,000	\$20,000,000 4 % S—Oct. 1, '97.	82 1/2	82 1/2	..	.....	100	10,000,000	.....	.....	..	..
Philadelphia Traction Co.....	50	1,000,000	\$400,000 6 % A—Mar., '97.	140	..	..	.....	100	10,000,000	.....	.....	..	..
Catherine & Bainbridge St.....	50	1,000,000	\$580,000 \$6 share—July, '97.	140	..	..	.....	100	10,000,000	.....	.....	..	..
Continental Pass. Ry. Co. guar.	50	600,000	.....	176 1/2	180	..	.....	100	10,000,000	.....	.....	..	..
Empire Passenger Ry. Co.....	50	1,000,000	\$475,000 \$7.50 share July '97	86	..	..	.....	100	10,000,000	.....	.....	..	..
Philadelphia City Pass. Ry.....	50	1,000,000	\$298,650 \$8.50 share July '97	86	..	..	.....	100	10,000,000	.....	.....	..	..
Philadelphia & Gray's Ry. RR.....	50	750,000	\$420,000 \$12 share July '97	300	..	..	.....	100	10,000,000	.....	.....	..	..
Ridge Avenue Passenger Ry.....	50	.....	\$200,000 \$2 share July, '97.	157 1/2	..	..	.....	100	10,000,000	.....	.....	..	..
Philadelphia & Darby Ry. guar.	50	.....	\$250,000 1 1/2 % S., July, '97.	157 1/2	..	..	.....	100	10,000,000	.....	.....	..	..
17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	\$335,000 \$11 sh. A., July, '97	275	..	..	.....	100	10,000,000	.....	.....	..	..
Thirtieth & 15th Sts. Pass. Ry.....	50	1,500,000	\$900,000 \$9.50 sh. July '97	227	228	..	.....	100	10,000,000	.....	.....	..	..
Union Passenger Ry. Co.....	50	750,000	\$750,000 \$10 share, July '97	225	235	..	.....	100	10,000,000	.....	.....	..	..
West Philadelphia Pass. Ry.....	50	.....	.....	.....	.....	.....	.....	100	10,000,000	.....	.....	..	..
Rochester, N. Y.—May 10:							New York.—May 10:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	10	13	Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	122	126
Reading, Pa.—May 10:							*Edison Elec. Ill'g Co., Brooklyn..						
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..	.....	100	4,000,000	3,750,000	1 1/2 % Oct., '97.	108 1/2	110
City Passenger Ry.....	50	350,000	350,000	Jan., '98.	112	..	.....	100	.....	.....	.....	10	18
East Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..	.....	100	.....	.....	.....	..	..
St. Louis Mo.—May 10:							Edison Electric Storage Co.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..	.....	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	85 1/2	85 1/2
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec., 1888.	..	..	.....	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	92	94
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 % Jan., '98.	120	122	.....	100	10,000,000	.....	.....	41	..
National Railway Co.....	..	2,500,000	2,479,000	1 1/2 % Jan., '98.	..	..	.....	100	10,000,000	.....	.....	..	..
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000	.....	90	110	.....	100	10,000,000	.....	.....	..	..
Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct., '98.	90	110	.....	100	10,000,000	.....	.....	..	..
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 % Jan., '98.	95	105	.....	100	10,000,000	.....	.....	..	..
Missouri RR.....	50	2,400,000	2,300,000	1 1/2 % Jan., '98.	170	172 1/2	.....	100	10,000,000	.....	.....	..	..
People's RR. Co.....	50	1,000,000	300,000	50c., Dec., '89.	50	52 1/2	.....	100	10,000,000	.....	.....	..	..
Southern Electric Ry..... com.	50	500,000	500,000	.....	100	102 1/2	.....	100	10,000,000	.....	.....	..	..
Southern Electric Ry..... 6 % pref.	100	1,000,000	1,000,000	1 1/2 % Jan., '98.	54	56	.....	100	10,000,000	.....	.....	..	..
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	175	..	.....	100	10,000,000	.....	.....	..	..
Union Depot RR.....	100	4,000,000	4,000,000	3 % A., July, '95.	..	..	.....	100	10,000,000	.....	.....	..	..
San Francisco, Cal.—Apr.							Pittsburg, Pa.—May 10:						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	110	110	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	..
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50	East End Electric Light Co.....	50	800,000	800,000	.....	..	10
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	53	Philadelphia, Pa.—May 10:						
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	8 1/2	..	Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	..
Scranton, Pa.—May 10:							*Electric Storage Battery Co. com.						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12	.....	100	8,500,000	.....	.....	21	22
Scranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	..	.....	100	5,000,000	.....	.....	28	25
Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	..	..	.....	50	5,000,000	.....	50c. p. sh., Oct. '97.	..	..
Springfield Ill.—May 10:							*Penna. Ht. Lt. & Pow. Co. com.						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11	.....	50	5,000,000	.....	6 % Oct., '97.	18 1/2	14
Springfield O.—May 10:							Northern Elec. Light & Power Co.						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2	.....	10	6,500,000	550,000	\$3.2500 dis. Jan. 11 '97	10	..
Springfield, Mass.—May 10:							Southern Elec. Light & Power Co.						
Springfield Street Ry.....	100	1,200,000	1,166,700	8 % A.	205	210	.....	10	187,500	187,500	.....	..	..
Toronto Canada.—May 10:							Miscellaneous.—May 10:						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	95	95 1/2	Brush Electric Co.....	50	.....	.....	.....	87 1/2	40
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	238	235 1/2	Bridgeport (Conn.) Elec. Lt. Co...	25	500,000	.....	.....	18	18
Washington, D. C.—May 10:							Missouri-Edison (St. Louis).....						
Belt Ry. Co.....	50	500,000	500,000	.....	72 1/2	73 1/2	.....	25	.....	.....	.....	125	128
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh., Oct. 97.	70	76	.....	25	.....	.....	.....	6	11
Columbia Ry. Co.....	50	400,000	400,000	6 % A.	9	..	.....	100	850,000	.....	.....	160	..
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	116	118	.....	25	175,000	.....	.....	88 1/2	85
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	..	..	.....	100	100,000	.....	.....	110	120
Metropolitan RR. Co.....	50	1,000,000	453,930	2 1									

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation of Electric, People's and Philadelphia Traction Companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 c Practically all shares owned by Union Traction Company.
 d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 e Leased to Electric Traction Company.
 f Controlled by

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—May 10, 1898						
The Albany Ry.....1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co.....Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....
The Albany Ry. Co.....Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....
Watervliet Turnpike & RR.1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....
Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co.....1st 5s	.....	.....	.....	.....	*105½	105½
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.						
Date of Quotation—May 10, 1898						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Exten. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	102½	103
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114½	115
Bal. Trac. Co. Coll. Trust. 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101½	.....
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103½	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	113	116
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113¾	114¼
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119½
The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. \$151,000 in escrow to retire 1st mtg. bds.						

Boston, Mass.						
Date of Quotation—May 10, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	101½	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	.....
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						

Charleston S. C.						
Date of Quotation—May 10, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.						

Chicago Ill.						
Date of Quotation—May 10, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101½	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	69	70
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	45	48
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	.....
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103	104
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100	100½
West Chicago St. RR. Cons. mtg. 5s.	12,500,000	6,000,000	1936	.....	90½	91¼
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chl. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.						

Cincinnati, O.						
Date of Quotation—May 10, 1898						
Old. New. & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	108½	.....
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	.....
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	129½	.....
Assumed by the Cin. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.						

Cleveland, O.						
Date of Quotation—May 10, 1898.						
aBrooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1908	M. & S.	106	107
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	101½
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	105	106
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	101½	.....
aEast Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	101½	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	1,000,000	.....	1922	M. & N.	.....	.....
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	.....	.....
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.						

Detroit, Mich.						
Date of Quotation—May 10, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,885,000	1905	A. & O.	96½	99
Ft. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	1902	A. & O.	.....	.....
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						

New Haven Conn.						
Date of Quotation—May 10, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	.....
Winchester Avenue RR. 1st mtg. g. 5s.	600,000	500,000	1912	M. & N.	106	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	102	.....

*With interest. *Unlisted.

New Orleans La.						
Date of Quotation—Apr. 31, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75½	77
New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1903	J. & D.	108	111
N. Or'l's City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98½	99½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	.....
Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	93½	100
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$990,000 outstanding.						

New York.						
Date of Quotation—May 10, 1898.						
Atlantic Ave. (Brooklyn).... Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	108
Atlantic Av. (Brooklyn) .. Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	*105	109
Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	106	119
Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	110
Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*112	114
Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*115	117
Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	106	*107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	113	116
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	84	87
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	90	91
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,800,000	1941	J. & J.	105	108
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	94	95
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	103	107
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	110	113
Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	300,000	1903	J. & J.	103	105
Dry Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	930,000	1932	J. & D.	114	117½
Dry Dock, E. Bd'y & Bat'y RR. scrip 5½.	1,100,000	1,100,000	1914	F. & A.	100	*103
Eighth Av. RR. Co. Cert. Indeb. 6½.	1,000,000	1,000,000	1914	F. & A.	108	.....
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
42d St., Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	85	90
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1935	M. & S.	114½	116
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	11,500,000	1927	F. & A.	112½	.....
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107½	108½
Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	106	.....
Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	106	111
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	117	120
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111½	114
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—May 10, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1903	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co.....	1,000,000	700,000	1916	M. & S.	105	107
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric.....1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	101
St. Louis & Sub. Ry.....Income 5s.	300,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	109½	110½
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	110	111
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Apr., 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferris & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
Omni-bus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	108½	.....
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Utter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—May 10, 1898.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home.....mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—May 10, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
Citizens St. R. (Ind'polis). 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	79	80
Crosstown St. Ry. (Buffalo). 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.). 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	103
Crosst'n St. Ry. (Colu's, O.). 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,331,000	1930	J. & J.	110½	111
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.). Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.). 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.). Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$950,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—May 10, 1898.						
Edison Elec. Illuminating Co., Boston.....	2,028,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	102½	.....
Pittsburg, Pa.						
Date of Quotation—May 10, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light. 4s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(May 10, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,156,000	1933	.....	114½	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia).....	2,000,000	.....	.....	.....	103	.....
Edison Electric Light (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—May 10, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	104
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—May 10, 1898.						
American Electric Heating.....5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. 10s.	.....	.....	.....	.....	.....	25
Barney & Smith Car Co. 10s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 6s.	11,000	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 12½c.; casting, 11½c.

The passenger receipts of the Nassau railway system, Brooklyn, N. Y., for the month of April were \$166,797, an increase of \$25,356 over the same month in 1897.

The gross earnings of the Brooklyn (N. Y.) Rapid Transit Company last month increased \$53,988; for the ten months ended with April there was a gross increase of \$233,684.

The Metropolitan Street Railway Company, New York, began operating electric cars on its Eighth avenue line on the 7th inst. The cars run from Fifty-ninth street to Central Bridge, at 152d street.

The annual statement of the Chicago Edison Company makes an admirable showing. The organization earned 9.04 per cent. on the stock; the gross earnings increased more than 8 per cent., while the operating expenses increased less than 4 per cent.

The Baltimore & Washington Transit Company, which is now operating an electric railroad from Takoma to Sligo, Md., has made a mortgage for \$500,000 to the Guardian Security, Trust & Deposit Company of Baltimore as trustee. The Transit Company proposes to extend the road to Sandy Spring, Md.

The Boston "News Bureau" says: "The question having been raised as to whether or not the Fort Wayne Electric Corporation was paying the coupons on its debenture bonds, we find upon investigation that the coupons are not being paid in Boston as usual, but that they are being paid upon presentation at the office of the company at Fort Wayne, Ind."

M. H. Buehler, general manager of the Pennsylvania Telephone Company, on the 4th inst. placed on record at Chambersburg, Pa., a mortgage to the Harrison Trust Company in the sum of \$500,000, on the entire property of the company in the several counties of the State in which it operates. The mortgage is for improvements and big extensions, connecting with new lines in Maryland and Virginia. Bonds have been issued.

The Pittsfield Electric Company has been granted the right to issue \$25,000 additional stock and \$100,000 bonds by the Massachusetts Gas & Electric Light Commissioners. The bonds are to be of the 5 per cent. ten-year variety, and \$75,000 will be issued for the purpose of taking up existing bonds and \$25,000 for new improvements. The \$25,000 stock is to pay floating debts.

The Pasadena & Los Angeles Electric Railway Company's franchises, rolling stock and entire plant were sold on the 28th ult. to Don C. Porter of Pasadena, representing the reorganization committee, for \$150,000. The bonded indebtedness of the road is \$350,000. A majority of the bondholders had previously signed the agreement and those that did not will now have to come in.

The Philadelphia "Stockholder" gives as a reason for the advance in the stock of the American Railway Electric Light Company the understanding that some people identified with the management of a leading railway system have recently caused an exhaustive test to be made of the device of the company for lighting trains by the utilization of the waste power of the wheels, and contemplate the acquisition of control, adding to their holdings with this object in view.

The earnings of the West Chicago Street Railway for four months this year have been \$1,203,774, against \$1,151,757 last year, an increase of \$52,017. The gains have been about 5 per cent. The April gain has been below the average, amounting to only 3.2 per cent., the result of bad weather. The West Chicago system comprises 262 miles of track, and in the month of March carried 6,361,472 passengers.

The stockholders of the Lewiston & Auburn Horse Railroad Company have voted to sell their road to the Brunswick Electric Railroad Company. The latter is a new company, and it is understood will assume the name of the Lewiston, Brunswick & Bath Electric Railroad Company. M. J. Googan and Hon. W. H. Newell, of Lewiston, have been elected directors. The new company will have headquarters at Lewiston, Me.

The Bluff City Electric Street Railway has been sold to a new corporation, the Chicago & Milwaukee Electric Railway Company, which proposes to complete the construction and equipment of the road. The directors of the Chicago & Milwaukee Electric are: George A. Ball, A. C. Frost, George M. Seward, F. S. Reeves and C. E. Loss. Mr. Ball is president, Mr. Frost vice-president and treasurer and Mr. Seward secretary. The new company has a capital stock of \$1,000,000 and it will execute a mortgage securing an issue of \$1,000,000 bonds. It is estimated that it will cost \$750,000 to complete the road, which will then be 31 miles long.

An increase of the capital of the Stillwater & Mechanicsville Street Railway Company from \$60,000 to \$250,000 has been approved by the New York State Railroad Commission. The increase is to be used by the company in the construction of a new line to run from Mechanicsville to Waterford, where it is to connect with the Troy City Railway. This is taken to mean that it is only a question of time when an electric through line will extend from Troy and Albany to Saratoga Springs.

In a suit by Patrick H. Flynn against the Coney Island & Brooklyn Railroad Company and others, the Second Appellate Division has affirmed an order granting a preliminary injunction restraining the company from executing and delivering a trust mortgage to secure the issue of negotiable bonds to the amount of \$1,500,000. The Court holds, in an opinion by Justice Cullen, that the provisions of the stock corporation law of 1892, relative to the power of a corporation to borrow money and mortgage its property, apply to a railroad corporation and limit the amount of a mortgage which it may legally give to the amount of its capital stock or to two-thirds of the value of its corporate property, if that be greater than its capital stock.

John L. Shea, Commissioner of Bridges, submitted to the representatives of the elevated roads of Brooklyn, N. Y., on the 10th inst. a proposition that if the bridge railroad is run in connection with the elevated systems the latter must pay 45 cents a car for each of 1,600 cars a day as a minimum and \$12,153.44 for rent of terminals and repairs, making the total charge \$274,953.44 a year. If the bridges system is leased to the elevated roads, then they must pay 10 cents for each of 2,500 cars a day and \$20,306.28 for terminals, making \$111,556.28 a year. The representatives of the roads did not say whether they would accept the proposition. Under the agreement made with the old bridge trustees they were to pay 12½ cents for each car crossing the bridge.

The Metropolitan Street Railway Company, New York, reports results of its sub-lines' operations for the quarter ended March 31 as follows: Second Avenue Railroad Company, a deficit after fixed charges of \$33,217, a reduction of \$30,382 from 1897, cash on hand \$2,918, and a profit and loss deficit of \$77,586. Twenty-eighth & Twenty-ninth Streets Crosstown, a deficit after fixed charges of \$6,470, an increase of \$8,728 over 1897, and cash on hand \$29,007. Fulton Street Railroad, a deficit after fixed charges of \$1,268, a decrease of \$28 from 1897, and cash on hand \$9,277. Thirty-fourth Street Crosstown, a balance after fixed charges of \$21,112, a decrease of \$19,726 from 1897, and cash on hand \$3,659. The Metropolitan Street Railway Company for nine months has earned 4½ per cent. on the stock. The full year will probably show 6½ per cent. earned. The company's general balance sheet as of March 31 shows: Assets—Cost of road, etc., \$31,898,901; stocks and bonds, \$14,891,472; other permanent investments, \$9,782,409; supplies on hand, \$272,930; open accounts, \$378,870; cash on hand, \$2,562,857; total, \$59,787,441. Liabilities—Capital stock, \$30,000,000; debenture certificates, \$6,000,000; funded debt, \$8,900,000; general and collateral trust mortgage bond account, \$12,500,000; interest, \$48,358; dividends unpaid, \$590,268; profit and loss surplus, \$1,748,814; total, \$59,787,441.

ELECTRICITY.

Vol. XIV.

NEW YORK, MAY 18, 1898.

No. 19.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4021 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	289-290
The Proposed Pan-American Exposition.	
An Electric Fire-Engine.	
The Electrical Exhibition.	
Under the Searchlight,	290
Mr. Coffin Becoming Aesthetic!	
Second Week of the Electrical Exhibition,	291
The Electro-Chemical Industries of England.	
(Special Article I.) By J. B. C. Kershaw, F.I.C.,	293
Electrolytic Refining of Lead. By Sherard	
Cowper-Coles, M. I. E. E.,	294
Electrically-Driven Machinery. By Dr. Schuyler	
S. Wheeler,	294
Electricity in the Hotel and Home,	295
London Notes,	295
What Electrolyzed Sea Water Has Accomplished.	
By W. L. Hedenberg,	296
Canadian Notes,	296
Effect of the War on General Industry. By	
Henry Clews,	297
National Electric Light Association—Special	
Rates To and From Chicago,	297
Society News,	297
Legal Notes,	298
The News,	298
Street Railways—Lighting Plants—Mines—	
Manufacturing—Company Matters—Personal	
and Miscellaneous—War Work of the Electricians.	
Recent Company Elections,	299
Commercial Paragraphs,	299
Incorporations,	299
Electrical Patent Record,	300
Telephone and Telegraph,	300
Electrical Securities—Stocks, Bonds, Etc.,	301
Notes for Investors,	304

EDITORIAL NOTES.

The Proposed Pan-American Exposition.

On the 29th of April a bill was introduced in Congress for the purpose of securing Governmental and Presidential recognition for the proposed Pan-American Congress which is to be held in 1901 at Cayuga Island on the Niagara frontier. The Exposition, in the opinion of the Committee on Ways and Means, will be of great value as an object-lesson to the people of the New World, showing them in what degree they have aided and participated in the development of industries during the past 100 years. The Committee in their report say: "It will also serve as a valuable reminder of those principles which were voiced in the utterances of the Monroe doctrine in the earlier days of the republic of the United States, and which have been emphatically reiterated in the reciprocity views of late days. The history of the United States and of many of the countries of North and South America practically began 100 years ago, and the accomplishments in various branches of human progress during the century have far surpassed those of any other period of the world's history."

In the opinion of the Committee, the Exposition should greatly stimulate the commercial relations between the countries of North and South America. They think that the Niagara frontier is peculiarly suitable for the requirements of such an Exposition, being the center of the largest population on the North American continent. Within a radius of 500 miles there is a population of 38,000,000, having unparalleled transportation facilities, both land and water. The Committee report continues:

"The Niagara frontier, intersected by the famous Niagara River, flowing from Lake Erie over the still more famous falls through the picturesque gorge to Lake Ontario, is a location of vast historical importance and great natural interest. At the inlet of the Niagara River is the thriving city of Buffalo, the gateway through which ebbs and flows a vast tide of traffic by land and water between the far West, the Northwest, the Dominion of Canada, the Atlantic seaboard, the great mining and industrial territory of Ohio and Pennsylvania, and the New England States.

"The Niagara frontier, being within the borders of the State of New York, can, with especial force, request recognition from Congress on account of its location, because recognition has already been extended to other sections of the United States. Expositions at which important Government exhibits have been made have already been held at New Orleans, Atlanta and Nashville in the South, at San

Francisco on the Pacific slope, at Omaha in the West, at Chicago in the middle West, and Pennsylvania was honored at the Centennial in 1876. An Exposition on a large scale, such as is now contemplated, has never yet been held within the borders of New York or the adjacent New England States."

It was originally intended that the Pan-American Exposition should be held during the summer of 1899, but owing to the more or less unsettled condition of the country it was deemed advisable to postpone the date. The year 1901 is said to have been selected to avoid any seeming discourtesy to the Paris Exposition of 1900. It is moreover thought that many valuable lessons may be learned and exhibits secured from the French Exposition.

A number of well known New Yorkers prominent in financial and mercantile circles are the organizers of the Pan-American Exposition Company. This organization was the outcome of the action taken by the American Exhibitors' Association at a meeting held at Atlanta, Ga., during the Cotton States Exposition, deciding that the Niagara frontier was a most suitable place for a big Exposition to be held if possible in 1899, and pledging the Association to support the enterprise should it be undertaken by responsible people.

Upon examination of various points suggested along the Niagara frontier, Cayuga Island was selected for the purpose.

This island contains some 200 acres of land, and is separated by a narrow stream called the Little Niagara from the mainland. Cayuga Island is situated between the cities of Buffalo and Niagara Falls, and is easily accessible from all the great trunk lines from east to west. The Exposition is to be Pan-American—that is, especially devoted to the interests of the countries of North and South America.

The joint resolution is similar in its scope to that adopted for the Chicago, Atlanta, New Orleans, Nashville and Omaha Expositions. It would seem that the great section of the country east of Chicago and north of Atlanta deserves recognition at the hands of the National Government. It simply authorizes the President to call the attention of the Governments in the Western Hemisphere to the intent and purpose of this Exposition after he has been fully satisfied that the financial resources of the company are fully assured. It also contains the usual clause permitting the exhibits of foreign countries to enter free of duty for exhibition purposes only, with the usual clause for the protection of the revenue, and requiring the company to pay all the expenses, including the salaries of customs officials in charge of the exhibits.

An Exposition such as the Pan-American Exposition Company proposes to hold should certainly benefit the electrical industry at a time when most of the

countries of South America are gradually awaking to the importance of electricity as a motive power. Being in the same hemisphere with South America, and its near neighbor, it is only natural to suppose that when a large demand has been created for electrical apparatus in that section, the United States will be the country that will do the largest amount of exporting. By helping to create a demand for electrical machinery and other manufactured products in South American countries, the proposed Pan-American Exposition should prove of immense benefit to our own manufacturers and of profound interest to all those associated in any way with the material advancement of the Southern republics.

* * *

An Electric Fire-Engine. An electric fire-engine has recently been invented by a resident of Indianapolis that will do away, so it is claimed, with many of the objections attending the use of the existing fire extinguishers. The device consists of an annular reservoir of metal, supported on suitable wheels, which goes to make up the main frame of the wagon upon which the rest of the apparatus may be mounted. The reservoir when not in use is kept empty. It is provided with a number of openings with nipples to each of which may be attached a line of hose. The openings are all equipped with suitable valves, enabling at any time a line of hose to be either attached or detached without in any way interfering with the operation of the engine. A large rotary pump is mounted upon the reservoir, and forces water directly into the latter, supplying from it all the lines of hose which may be attached. The pump is operated through a set of gear wheels by an electric motor. The conducting wires are wound on a reel mounted near the motor in such a way as to enable them to be readily drawn off and attached to any suitable source of power such as trolley wires, electric light wires or established stations that every city would be obliged to put in on adopting electric fire-engines. The rotary pump is so arranged that it may draw its water supply either from a cistern, river or directly from the ordinary fire plugs.

There are several advantages claimed by the inventor for the electric fire-engine over the steamers now generally in use. It does away in the first place with the reciprocating pump, which is said to be inefficient, and enables the boiler to be discarded. Thus the weight of an electric fire-engine is but 3,600 pounds, considerably less than that of the ordinary type of engine. Furthermore, a number of lines of hose can be successfully operated from the same reservoir in this new device, whereas at the most but two could be attached to the old form of fire extinguisher.

On the other hand there would seem to us to be one serious objection to the electric fire-engine which it would prove difficult to overcome, or at least would take considerable time and missionary work to induce city officials to see it in the proper light. A city in adopting this new device would have to make connections with either underground cables or overhead wires, so as to lead the current to, say, every hydrant or other accessible point where in case of a conflagration an engine could obtain a sufficient amount of current for the operating of the pump. In the case of a sparsely settled district, as for instance the outskirts of a city, this would undoubtedly prove an expensive undertaking.

Another vital point which should not be overlooked in this connection is the danger of a break occurring somewhere in the electric circuit, as frequently happens with both telegraph and trolley wires during heavy storms. Were such an event to take place, and a fire to break out, the electric fire-engine would be useless. Electricity unquestionably has its field of application, but we doubt whether the electric fire-engine would prove a success under existing conditions.

The Electrical Exhibition. As the third week of the Electrical Exhibition opens it is really surprising to note how the attendance is increasing. This is principally owing to the fact that those who have once visited the show explain to their friends the necessity of visiting Madison Square Garden and keeping up to date in electrical progress. Even in the short space of two years, since the last Electrical Exhibition held in New York, electricity has found many new and useful applications which are fully illustrated at the present Exhibition. Causing a bell to be rung through the medium of electricity without the use of wires, over a distance of about 180 feet, or from the south to the north gallery of the Garden, ordinarily fills the unscientific visitor to the show with wonder.

A business man might travel day in and day out on one of the electrically operated lines of the Metropolitan Traction Company without having the most remote idea how the car on which he was riding was propelled. At the Exhibition at the Garden a full sized car is kept moving backward and forward over a short section of conduit; the latter, open at both ends and lighted internally by a number of incandescent lamps, allows the visitor to see exactly how the current is collected and delivered to the motors. The management are constantly striving to make the show not only attractive but instructive as well, and needless to say, they are succeeding beyond their fondest expectations. It is not saying too much to state that the show now going on in Madison Square Garden is a liberal education in itself. From the beautifully arranged wax figures in the Concert Hall, representing the birth of electricity, to the operating dynamos in the basement, which embody the highest state of the art we have yet reached, there is an immense amount of valuable information to be gathered.

Under the Searchlight.

Notes and Comments on Various Topics.

THE following from the *Boston Commercial Bulletin* of May 14 sizes up in an excellent manner the situation in regard to the methods of the General Electric Company. The last paragraph is especially true, and the only way it can be accounted for would seem to be in the fact that there is a fool born every minute:

General Electric also received some special attention for the first time in several weeks. The rumors accompanying the two or three point advance were of the familiar type, the flat statements being made on Wednesday that arrangement had been made with rival concerns, that a scaling of capital and paying off of accrued dividends on the preferred stock were in contemplation.

All this was taking the future pretty abruptly in hand. But the truth is, that in this, as in other stocks, the purpose of manipulators seems to be merely to take advantage of a general upward tendency in prices, and having bought on reactions in the market, to get the best price obtainable through circulation of some such bullish "rumor." The outside public is on the whole rather quick to bite at such bait.

* * *

A VERY compact electric plant is said to have been installed in a Chicago commercial house, in which one dynamo is made to do the work of two. This machine has a double set of armature windings and two commutators, being so designed that both 110-volt and 220 volt circuits can be run from the single dynamo. Each commutator gives 110 volts, and for lighting purposes the circuits are so grouped as to maintain approximately an equal number of lights on each side of the machine. For running the elevator motors, which require 220 volts, the two 110-volt sides are connected in series, thus giving the required pressure. This connection is carried out by a special arrangement of switches on the switchboard, each commutator of the machine being connected to a double pole single-throw switch, which is connected to half of the 110-volt incandescent lighting

system. Each commutator is also connected to a three-pole switch for the power circuit. When this switch is closed, the two commutators are connected in series, but when open they are entirely independent. Over 600 incandescent lamps and 46 incandescent arc lamps are run from this machine, in addition to two electric elevators, one for passengers and one for freight.

* * *

THE Boston, Mass., *Advertiser* refers to the rumor that the General Electric Company contemplates doing something in the way of a settlement of its accumulated dividends as follows:

The alleged "plan" of settling with General Electric preferred stockholders by giving them new stock for their accumulated dividends and reducing the dividend rate to 5 per cent. is amusing. This would make about \$10,000 difference in dividends per year and would put the preferred shares on a basis of selling price too low to think about. Well about 60 is the most that could be expected of an industrial stock paying 5 per cent. When it is added that debentures may be reissued, that caps the climax. Probably this preferred plan is not within gunshot of what it will be. But the cutting of the common in two is just as likely as the other is improbable.

* * *

AFTER several weeks of hard labor General Superintendent Baker of the Telephone Company has discovered the cause of an interruption of the telephone service in the borough of Stonington, Conn. For a long time the subscribers in Stonington have been annoyed by the failure to get "Central" by repeated ringing. The central office for Stonington is located at New London. The service was all right during the day up to 9 o'clock at night, but after that hour communication was out of with the outside world. Efforts were repeatedly made to discover the cause of the mischief, and finally linemen were sent out from New London and outside of the city they tapped the main wire. It was found that the trouble lay somewhere near the railway station, and by testing from post to post it was located at a railroad crossing where the arm of a safety gate was found to be resting against the wire, grounding the current and shutting off communication. The arm was removed and "bellos" immediately began pouring into the ears of the New London operator like a rush of water from a canal when the gates are opened.

* * *

Mr. Coffin Becoming Esthetical.

(From the *Schenectady Union*.)

All of the many acres of land owned by the General Electric Company will not be used for commercial purposes, for in a short time a large plot at and about the main entrance of the works will be converted into a bower of beauty.

The land is now being sodded and in time numerous flower beds will be laid out. The work is under the supervision of a noted Rochester landscape artist, and he promises to create the most beautiful spot in Schenectady.

The garden is being made at the personal suggestion of C. A. Coffin, president of the company, and he is taking much interest in the work.

* * *

AMONG the prominent citizens of a certain town are the Blanks, who are said to have made a large fortune through a well-known electrical invention, and whose luxurious home is fitted up with all the electrical improvements that make life worth living. Wealth has not spoiled Mrs. Blank, however. She still continues the most simple-hearted, old-fashioned and conventional of women. Not long ago a friend of Mr. Blank paid his first visit to the house. "By the way," said the host, as he bade his guest good-night, "when you want your bath in the morning you needn't take the trouble to go to the bathroom. Just press this button and the tub will come to you." The guest, accordingly, did as he was bid, and when he wanted his bath the next morning he merely pressed the button. Sure enough, a secret door flew open in regular Arabian Night style, and the tub sailed in. But evidently there had been some miscalculation, and they hadn't counted on the guest wanting his bath at just that hour. For in the tub was—Mrs. Blank.

SECOND WEEK OF THE ELECTRICAL EXHIBITION.

An Unusually Large Attendance—The War Bulletins Produce Patriotic Demonstrations—Telegraph Tournament a Feature of Interest—Greatest Exhibition of the Kind Ever Held in New York

The Electrical Exhibition in Madison Square Garden is now in full swing, and thanks to the untiring energy and perseverance of the management everything is running smoothly, and the many exhibits and special features of interest are attracting wide attention. The practical uses to which electricity may be adapted for lighting, heating and power purposes are a revelation to those who are uninitiated. A unique and novel feature is the high chandelier, bearing scores of arc lights, which one sees on entering the main hall. This has been appropriately named an "aroclier," and is the first attempt to use arc lights in such a manner. The great electric fountain in the center of the Garden, and on which Mr. Thomas A. Edison, Jr., is said to have spent a great deal of time, is now in thorough working order and is another source of delight to the visitor.

The Moore Chapel, with its vacuum tube lights, continues to attract general attention and to call forth many expressions of admiration. The collection of medals which is to be found in this same apartment, produced by the "galvanoplastic" process, well repays a careful examination. Other reproductions of natural objects, such as leaves, fish, frogs and snakes, obtained in the same manner, are also shown. It is through the courtesy of Mr. H. V. Parsell, the well-known banker of this city, that these interesting electro-depositions have been placed in the hands of his son, Mr. H. V. Parsell, Jr., the electrical engineer, for exhibition. It is doubtful whether any other amateur can show anything approaching this remarkable collection in beauty and interest. While gazing at this collection it may interest some of our readers to know the manner in which the reproduction of live animals is accomplished. In making a galvanoplastic reproduction of a snake, the latter is first etherized under a bell jar, then taken out and greased with sweet oil and replaced in the jar while a sufficiency of thin plaster is mixed with warm water. The snake is then placed on a glass plate and posed. When the plaster is hard it is freed from the sticks and glass plate, and the now defunct reptile is carefully removed, tail first, from his intaglio impression. The plaster cast thus obtained is rendered waterproof by immersion in molten paraffin. A metallic conducting surface must now be given to the interior of the cast. This is done by moistening the surface of the mould with a solution of silver nitrate and by exposure to sulphuretted hydrogen, precipitating the silver on the cast. A conducting wire is fastened around the edge and the mould is carefully suspended in the depositing bath. A good firm coating takes about three days to form, and then the mould is softened in boiling water and carefully broken off.

The Marconi system of wireless telegraphy continues to be made use of for firing the submarine mines. Crowds gather four times a day around the tank and wait patiently to see the miniature men-of-war blown to pieces.

The Telegraphic Tournament that had been looked forward to with much interest was begun Saturday afternoon. The contests were held under the management of Mr. Fred. Catlin, and three classes tested their ability at sending messages from one of the ante-rooms of the Concert Hall into the main auditorium. About twenty-five young women and men holding positions in the largest telegraph offices of the country took part. In the women's class, which required the sending of the greatest number of words in five minutes, the first prize was won by Miss J.

McManus, the second by Miss Emma R. Vauselow.

In the class requiring the sending of 230 words in four minutes, the first prize was won by Charles F. Edney, the second by F. M. McClellie of Memphis, Tenn.

In the 240 words class, J. D. Hinnant won first prize by sending 253 words, and F. M. McClellie won second, sending 243 words.

The most interesting part of the tournament was reserved for the night session. This contest included four classes. The first was the message-receiving class in which fifty messages of the ordinary run of from thirty to thirty-five words were to be received. The time of this contest was about 32 minutes and a-half, decision being reserved, as it was necessary the judges should have an opportunity of comparing each man's work.

In the five-minutes' code-sending class the first prize was won by G. W. Conkling, who sent 345 words in a minute, the second prize going to W. M. Gibbon with 330 words.

In the code-receiving class decision was reserved to give the judges an opportunity to compare the records.

The fourth class, known as the championship event, was the sending contest for five minutes. This was won by William M. Gibson over Fred. Catlin by three letters.

Altogether the results of the tournament were exceedingly gratifying and proved a great drawing card. In the evening Mr. Thomas A. Edison was present and acted as one of the judges.

COMPANY EXHIBITS.

The Babcock & Wilcox Company exhibit under actual working conditions, generating all the steam used in the Exhibition, two of their 250 HP. boilers of the forged steel inclined header type, which were built for the Metropolitan Street Railway Company, being part of an order of 16,000 HP. for the Metropolitan Company's power station at 96th street, New York. These boilers are built entirely of forged metal and are designed to carry 200 lbs. working pressure. This is the standard pressure now adopted by the Babcock & Wilcox Company for their high pressure work, but they are prepared to build on order boilers to carry any pressure in excess of this. In addition to the boilers under steam, the exhibit includes a model showing the interior arrangement and construction of the boilers and several examples of the steel forgings used in construction. These forgings are the result of long experiment, and the forged header especially is an interesting specimen of the high-class work that places the Babcock & Wilcox Company in the lead of builders of high pressure safety boilers.

The exhibit of the Fostoria Incandescent Lamp Company of Fostoria, O., attracts a crowd nightly owing to the brilliancy of several groups of red, white and blue lamps. The intensity of light which these lamps give out is frequently remarked upon and speaks well for the Fostoria "Duplex."

Stanley & Patterson of 32-34 Frankfort street, New York, have a varied and tastefully arranged exhibit located on the north promenade. This well-known concern is exhibiting among other things long distance and exchange telephones, toll line cabinet sets, electric light specialties, switches, electric bells, annunciators, wire, fans, desk lights, shades and Shelby incandescent lamps. The booth is brilliantly lighted by fifty-five 16 CP. incandescent lamps of different colors, nicely arranged, and by two

incandescent arc lamps. A full line of high grade electrical supplies for lighting, bell and telephone appliances may here be seen.

The Safety Insulated Wire & Cable Company of 225-241 West 28th street, New York, have a unique and exceedingly attractive exhibit situated on the north promenade. Among other things a glass tank filled with water in which floats a cruiser is shown, with an imaginary channel marked out by electrically illuminated buoys. Gold fish may be seen playing around the keel of the vessel, and the latter is so arranged that it may be moved forward between the lighted buoys. A miniature electric light also burns on the vessel. Attractive souvenirs are given away by this company showing the various layers of insulation on a cable. Altogether this is one of the most unique company exhibits in the building and attracts large gatherings nightly.

The Baylis Company, engineers and contractors, of 99 Cedar street, New York, are exhibiting jointly with the National Meter Company in the basement a 30 horse power double cylinder "Nash" engine direct coupled to a Walker generator. The Nash engine on exhibition has been especially designed for electric lighting service, and the exhibit is intended to show the developments made in the last few years in gas engines. The exhibit, moreover, shows that it is possible to obtain perfectly steady lights and regulation from no load to full load in a direct connected gas-engine electric lighting unit. Such an arrangement shows the feasibility of installing a complete electric lighting plant in a space where a steam engine and boiler, or even a belted gas-engine, would be prohibitive. A complete electric lighting plant in which a Nash engine is used of 300 lights capacity would occupy a floor space of but 10 x 5 feet. The Baylis Company exhibit may be seen any evening in operation furnishing lights to a portion of the Garden.

One of the most interesting features of the Electrical Show is the booth of the International Correspondence Schools of Scranton, Pa., whose New York enrollment office is located at No. 14 East 17th street. No better proof of the popularity of the methods of instruction employed by this institution could be shown than to watch some of their old students taking their friends away from the spectacular end to have them talked to by representatives of the Schools. The large number of friends they have around them is accounted for by the fact that they have now over 45,000 graduates and students throughout the world. The booth of the Scranton Schools, which by the way is located on the Fourth avenue side of the Garden, is very attractive. A picture of the school buildings 5 x 7 feet in size, surrounded by electric lights, showing the picture off to great advantage, hangs at the back of the booth. All engineers and electricians attending the Exhibition who desire to obtain a technical education in engineering or electricity will find it to their interest to visit this booth.

A very attractive exhibit is that of F. A. La Roche & Co. of 652 Hudson street, New York, the manufacturers of the well-known "Ideal" circuit breakers. This firm has on exhibition one of its modern switchboards, which was recently built for a large drygoods store in this city. On it is mounted the well known "Ideal" circuit breaker and the La Roche self-looking switches. The board is not only beautiful in appearance, being made of Knoxville gray marble, but is extremely substantial owing to its being mounted on heavy angle iron frames with brass pedestals. The bus bar work on the rear shows the high class of work this firm is in the habit of turning out. Another switchboard is also shown containing ten "Ideal" circuit breakers ranging in size from 25 to 2,000 amperes, with both single and double pole. The management report that the firm is extremely busy, it being necessary to run the factory 18 hours a day to supply the constantly increasing demand for their improved circuit breaker. This

company's booth is handsomely decorated and is illuminated by the La Roche alternator and direct current arc lamps. The main panel switchboard which controls the power and light for the entire Exhibition was manufactured and installed by F. A. La Roche & Co. The exhibit of this company at Madison Square Garden is in charge of Messrs. A. E. Wells, F. A. La Roche and J. A. Loutey.

The Riker Electric Motor Company of Brooklyn, N. Y., are exhibiting two of their well known electric motor vehicles. One is a delivery wagon manufactured for B. Altman & Co. of New York, while the other is a handsome victoria. A two-horse-power motor geared to the rear axle drives the delivery wagon, the motor and running gear being enclosed to prevent any accumulation of dust. The battery is located under the driver's seat, extending back a short distance into the body of the wagon. By means of removable side panels the batteries may without difficulty be taken out and recharged. Under ordinary conditions a delivery wagon of this nature will run from 25 to 30 miles

materials for rails and wire and a large assortment of sheet cork insulation for heat and cold. This company's cork steam pipe and boiler covering is used throughout the Exhibition.

SOCIETY MEETINGS.

A large number of lodges that go to make up the National Association of Stationary Engineers have still to hold meetings in the Concert Hall of Madison Square Garden as follows: May 18, No. 39, New York; May 19, No. 23, New York; May 20, Phoenix, No. 24, New York; May 21, No. 3, New Jersey, No. 8, New York; May 23, Nos. 32 and 47, New York; May 24, No. 1, New York; May 25, Nos. 55, 41, New York; May 26, No. 44, New York; May 27, No. 25, New York.

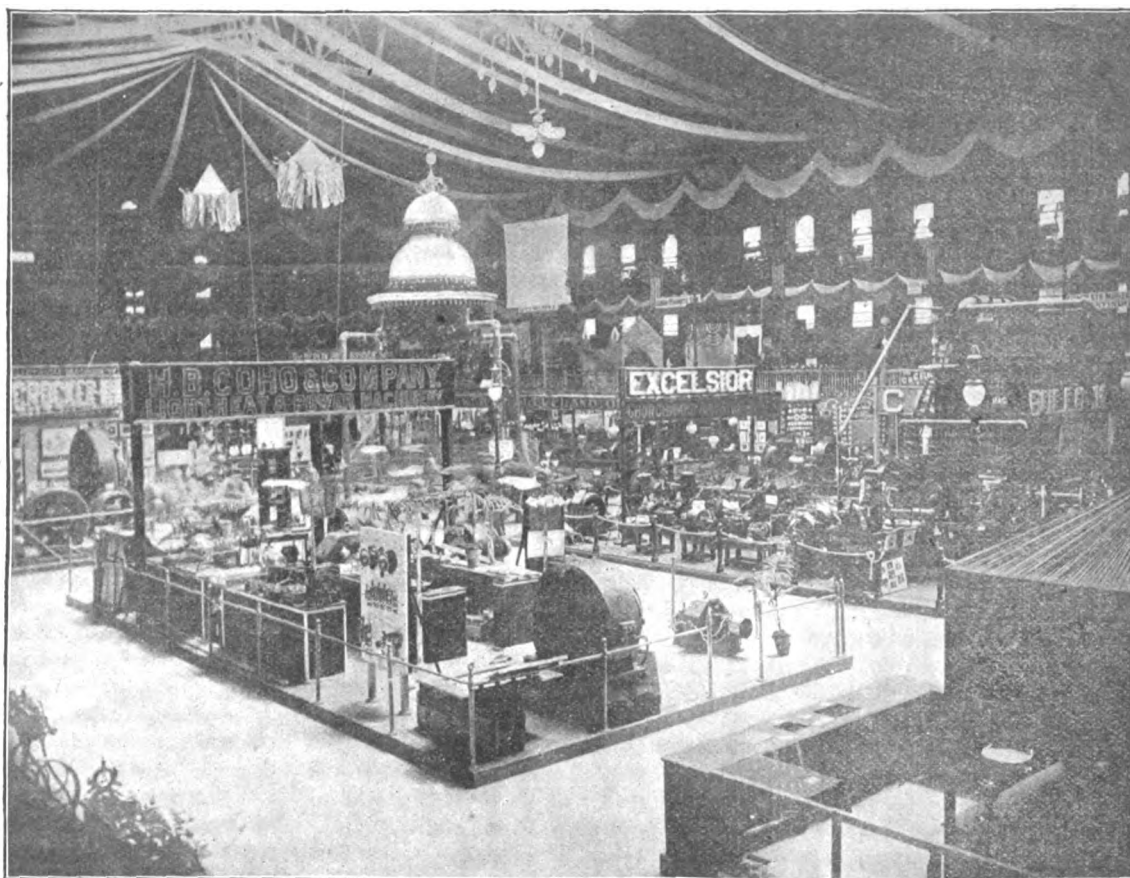
A weekly meeting of the New York Electrical Society will also be held at which papers on various topics of interest will be read. The second lecture of the Society's Exhibition series will be given in the Concert Hall on Thursday evening, 19th inst., at 8:30, by Professor J. Fujioka, of the Imperial Uni-

long exposures, to prevent them being fogged by diffused rays from the back or sides.

"Of the rays which are given off by the platinum plate of a focus tube, those are most effective for producing pictures which leave the platinum at as great an angle as possible, within a limit of 80°. The specific transparency of bodies is greater the thicker the body.

"The ratio of the thicknesses of two equally transparent plates of different material is dependent on the thickness and the material of the medium through which the rays have to pass before they reach the plates. For instance, the ratio of thickness of platinum and aluminum plates of equal transparency will be reduced to one-half if the rays are passed through a thick glass plate before they strike the metal plates.

"Roentgen, like Swinton and others, has shown that the contrast between bodies of different transparencies depends on the EMF. used to excite the tubes. A spark gap in the secondary circuit acts in the same way as an intercalated Tesla transformer; both pro-



VIEW OF THE ELECTRICAL EXHIBITION FROM NORTH PROMENADE.

without the batteries requiring to be recharged. The total weight of the vehicle, including battery, which in itself weighs 1,000 pounds, is 2,900 pounds. This company also manufactures surreys, buggies and traps.

The Gold Street Car Heating Company of Frankfort and Cliff streets, New York, are exhibiting a large assortment of electric heating devices used not only for warming cars and boats but buildings as well. All of the heaters exhibited by this company are fitted with the well known Gold improved resistance coil and support, and are moreover very handsome in design.

The Diesel Motor Company of New York are exhibiting, on the north side of the basement, a 20-horse-power motor which was recently imported from Germany. This motor, which may be seen in operation any evening, is run on petroleum. Thorough tests of this motor will be made under variable loads at the close of the Exhibition.

The Nonpareil Cork Manufacturing Company are exhibiting a full line of their well known insulating

versity, Tokio, Japan, on "Electricity in Tokio and the Kingdom of Japan."

Roentgen on the Roentgen Rays.

"Such a host of investigators have devoted themselves to the development of Prof. Roentgen's great discovery," says the *Electrical Review*, London, quoting from *Elektro Zeit.*, 19, p. 192, "that it would be no matter for surprise if there was nothing left for the discoverer to find out about his own discovery. Some novel properties of the X-rays, however, have been described by Prof. Roentgen in a third communication on this subject to the Berlin Academy. Among these the following appear to be especially interesting. If a fluorescent screen is covered with a plate completely opaque to the X-rays, a slight fluorescence can nevertheless be seen when the tube is in action. Roentgen has shown that this is due to rays proceeding from the air of the room, which emits X-rays wherever it is itself exposed to their action. This fact points to the necessity of placing photographic plates in a sheath of lead when used for

duce more intense and less easily absorbed rays. By the use of a Tesla transformer and wire electrodes in a narrow tube, X-rays can be produced with a vacuum of 3.1 mm., the usual vacuum being, of course, about 0.0002 mm. Hard tubes, as Roentgen calls those tubes which require a very high EMF., can be softened, as is well known, by heating or by readmission of air, or, as is not so well known, by heating limetree charcoal placed in a side tube, or by sending through the tube a very powerful discharge. The composition of the rays given off by the platinum anti-cathode depends essentially on the time change of the discharge current. The quality of the rays is not affected by the change of the primary current, but their intensity is proportional to the strength of the primary current."

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1898.

THE ELECTRO-CHEMICAL INDUSTRIES OF ENGLAND.

ARTICLE I.

(Specially Contributed by JOHN B. C. KERSHAW, F. I. C., London.)

Twenty years ago the industrial applications of electricity in Europe in the domain of chemistry and metallurgy were limited to two manufactures—that of electro-plate, a business in the hands chiefly of the famous Birmingham firm of Elkington Bros., and that of refined copper. The latter industry was carried on upon a very small scale of operations, and the combined output of the Pembrey and Hamburg refineries—the two largest at that date—did not much exceed 1,000 tons per annum, while the total number of refineries in Europe was only six or seven.

Ten years later, electro-plating and copper refining were still the only two electro-chemical industries. But the latter industry had steadily increased in Europe under the stimulus of the demand created by electrical engineering for the purest form of copper, and the electrolytic method of copper refining had been introduced into the United States by the Balbach Company of Newark and by the Baltimore Smelting & Refining Company. At this date there were four electrolytic copper refineries in operation in England, with from eight to twelve scattered over the Continent of Europe.

The progress that has been made since 1888 has however been remarkably rapid, and while ten years ago there were many who believed electricity would have but a very minor rôle to play in the chemical and metallurgical industries, the enormous expansion of the electrolytic copper refining industry, and the marked success which has attended the use of electrolytic methods in the manufacture of aluminum and chlorate of potash, have now reduced the number who hold this belief to a very small minority of the community.

This change in the views of practical men with regard to the possibilities of electricity as an agent for promoting chemical reactions upon a manufacturing scale, is due to the rapid growth of the past ten years.

There are now no fewer than eighteen distinct electro-chemical or electro-metallurgical manufactures carried on in different parts of Europe and America in over 150 manufactories, while the production of one article—electrolytic copper—has increased from between ten to twenty thousand tons in 1887 to over 150,000 tons in 1897—that is, to an amount nearly equal to one-half the total copper production of the globe.

This progress would have been impossible except for the cheapened sources of electricity that are now available when current is required in large quantities.

The experience gained in the period 1880-1890, when electric lighting was absorbing all the attention of electrical engineers, has led to valuable improvements in the efficiency of both engines and dynamos, and the more recent development of large water-powers for manufacturing purposes has still further tended to reduce the cost of electrical energy. This is to-day being produced for manufacturing operations at a cost which twenty years ago would have been considered below the limits of possibility.

Great as the electric lighting industry has become in both Europe and America, there are only few lighting installations in either continent with a dynamo capacity equal to that of some of the larger and more important industrial undertakings of the character now under consideration.

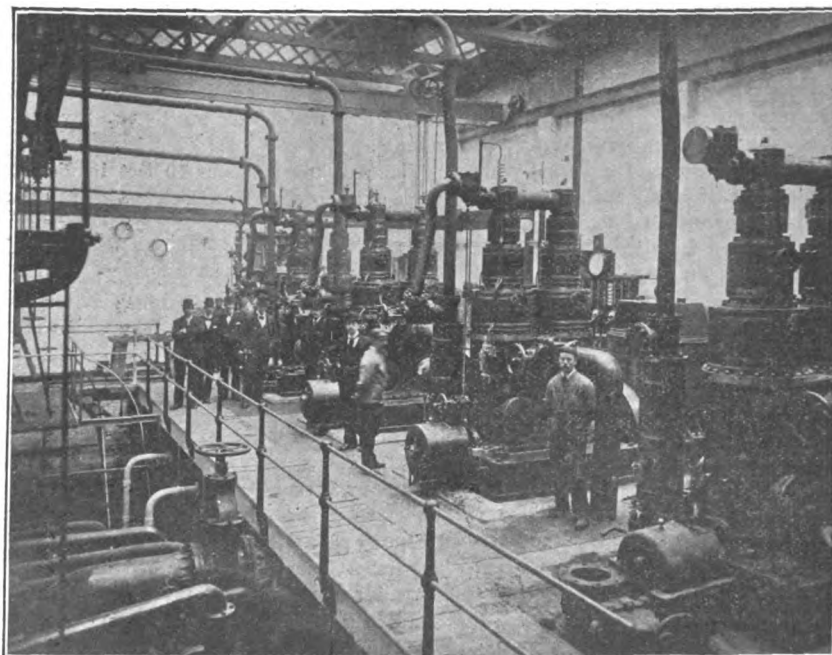
In these electro-chemical industries, single power plants of between 2,000 and 4,000 HP. are common; and the greater portion of the power to be developed from the numerous water-falls of both the New World and the Old will undoubtedly find utilization in these comparatively new industries.

In England, owing to the lack of large natural water-powers suitable for industrial development, the electro-chemical developments that have occurred have with two exceptions had to depend upon coal for their supply of the electric current; and two of these undertakings possess steam plants of the most modern description for generation of their electrical energy.

The writer has been fortunate in obtaining from

tro-Chemical and Electro-Metallurgical Industries of Europe."

The Castner Kellner Alkali Co.—Two views are given of the works of this company at Weston Point, Lancashire. The company was formed in 1896 with a capital of \$1,440,000 and the manufacture of caustic soda and bleach by the first 1,000 HP. installation of plant was commenced early in 1897. The results of the working of this plant have been satis-



ENGINE AND DYNAMO ROOM OF THE CASTNER-KELLNER ALKALI WORKS, WESTON POINT, ENGLAND.

those at the head of some of the more important electro-chemical industries in England permission to use, in these two special Articles, certain photographs which they have placed in his hands. These will, it is hoped, help to convey to the readers of *ELECTRICITY* a more correct idea of the scale of operations than is possible by written descriptions; and they will also, where views of the engine plant are included, show the type of engine that has been

factory, and the extension of the works to the originally designed capacity of 4,000 HP. is now proceeding. The shares of this company were quoted at a premium at the commencement of the present year, a fact that speaks well for the confidence of the investing public in the future of the undertaking. The process depends upon the decomposition of a solution of common salt by means of the electric current, mercury being used as cathode material and



CELL ROOM IN THE CASTNER-KELLNER ALKALI WORKS, WESTON POINT, ENGLAND—CAPACITY 1,000 HP.

adopted for generating these large units of power. Only a brief account of the chemistry of the process or of the apparatus used will be given; readers desiring fuller information concerning these are referred to the previous issues of *ELECTRICITY* in which they have been dealt with at considerable length by the present writer, under the heading of "The Elec-

carbon for the anodes. By a mechanical device the cells are subjected to a periodic tilting movement which brings the sodium amalgam formed at the cathode into contact with water, and, whilst regenerating the mercury for use in the cathode compartment of the cell again, produces a solution of sodium hydrate practically quite free from sodium chloride. The

chlorine liberated at the carbon anodes is conducted away, and is used in the ordinary manner for the manufacture of bleaching powder.* The English Castner-Kellner Company has made a deal with the "Deutsche Solvay Werke Aktien Gesellschaft" whereby the latter company has undertaken to accept delivery of the whole of the bleaching powder produced at Weston Point during three years at a fixed price. This arrangement of course gives stability to the position of the Castner-Kellner Company and ensures a market for its products. Owing to the output of bleaching powder by this company and by the other electrolytic alkali company at St. Helens, the market price of 35 per cent. bleaching powder has already dropped about \$5 per ton, and a further fall may occur during the present year. Some difficulty has arisen, it is believed, in the conduct of the electrolytic process, due to the impurities of the brine pumped from the Cheshire salt mines, and the second 1,000 HP. installation of plant is to be used for the production of caustic potash from Staßfurt potassium chloride. It may interest readers of *ELECTRICITY* to know that this process is now at work at Niagara in the factory of the Mathieson Alkali Company, and 1,500 HP. is now utilized at this spot in the production of caustic alkalis and chlorine products. A minimum royalty charge of \$19,000 per annum is to be paid by the Mathieson Company to the Aluminum Company of Oldbury, England, who at the date of this agreement were the owners of the American rights of the Castner-Kellner process.

ELECTROLYTIC REFINING OF LEAD.†

BY SHEPARD COWPER-COLES, M.I.E.E., A.M.I.C.E.

Lead, when recovered from its ores by smelting, is obtained as a crude metal, the so-called work lead, which has to go through a refining process in order to obtain soft or market lead. Work lead is obtained either by roasting reactions, by reduction, by roasting and reduction, or by the precipitation process. Refining is effected either by oxidation after fusion or by electrolysis. Lead is never obtained pure when smelted from the ore. It is almost always alloyed with all the other metals contained in the ore itself. Apart from the fact that the useful properties of the metal are affected by these other metals, it is, of course, advisable for economic reasons to recover the precious metals present, such as silver.

One of the first processes worked on a commercial scale for the electrolytic refining of lead by electrolysis was that of Keith. In this process the crude or work lead is melted at the lowest possible temperature in iron kettles from which it is tapped into moulds. The anodes thus produced are fastened to metal rods by suitable clamps, and enclosed in close-fitting bags of coarse muslin. The electrolyzing cells are made of wood or iron; the cathodes are thin metal plates attached to rods in a similar manner to the cathodes. The electrolyte is composed of lead sulphate dissolved in an aqueous solution of acetate of sodium; it is made by electrolyzing with lead anodes a mixture of $1\frac{1}{2}$ lbs. of acetate of sodium, 2½ ounces of sulphuric acid, and 1 gallon of water, and is heated to 38° C. The sulphuric acid attacks and the acetate dissolves the lead, zinc and iron of the anodes. The zinc and iron, being electro-positive to lead in the liquid, are less easily reduced to metal and accumulate in the solution, and when dissolved in considerable quantity are, to some extent, deposited as oxide on the cathode, the current density employed being about 1.86 amperes per square foot. The lead which is deposited on the cathode is crystalline in form and separates continually from the plates, a space being left in the cells for its accumulation. When the anodes have been dissolved, the

bags suspended from their supporting rods are carried to a reservoir and the residual solid matter from the plates is washed and returned to the melting kettles. The slimes suspended from the wash water are allowed to settle, the water is drained off, and the residue filtered. The slimes usually contain antimony, arsenic, silver, copper, gold and iron. A process that has been recently tried on a commercial scale is that of Tommasi. In this case, the electrolyte is the double acetate of lead and potassium (or sodium), the anodes are crude argentiferous lead, and two of these are opposed to a copper or aluminum alloy cathode, which is in the form of a disk rotating at the rate of from one to two revolutions per minute.

These disks are about 10 feet in diameter and three-quarters of an inch thick and are half immersed in the liquid. At the upper part are scrapers which serve to detach the small spongy crystals of lead which form during electrolysis. The crystals when removed fall into channels which convey them to a sieve of wire gauze where they are drained and washed, the wash water being concentrated by evaporation to 20 Baume (sp. gr. 1.256) and used again in the electrolyte. The lead is then compressed and mixed with 2 or 3 per cent. of charcoal powder and fused. The silver, with most of the arsenic and antimony, is separated at the anode, and is collected in trays to be fused subsequently with sodium nitrate and a little borax, by which the silver is separated from the arsenic and antimony.* The cost is estimated by the inventor at from 8 to 10 francs per ton of lead when steam power is used. When lead acetate is used as an electrolyte, the resistance is found to be lowered, which is probably due to the prevention of lead peroxide deposits upon the anodes, which must be at the expense of the organic substance itself, which becomes slowly and surely oxidized. The products of the oxidation of acetic acid are carbonic acid gas and water, which are of no intrinsic value. This being the case the acetic acid becomes an expensive electrolyte as it has to be constantly renewed. The lead peroxide formed at the anode is reduced by a portion of the organic acid to oxide, which then dissolves in the acid and becomes finally reduced to metallic lead at the cathode. The impurities present in the crude metal and the oxides on the face of the anodes are usually bad conductors of electricity, and, if they do not become detached from the anodes, they form an insulating coat over a large portion of the anode surface. The natural consequence of this is, that the current passes mainly through those parts of the plate that remain freely exposed, and so the current density becomes greatly increased at those portions, with the result that the anode is rapidly riddled with holes. The addition of fluid carbonic acid when mixed gradually with sulphuric acid and digested for some time at a temperature of from 50 to 100° C. easily converts it into cresol sulphuric acid, which is soluble in water, and is capable of forming soluble salts with lead. These salts have been successfully used for the deposition of lead.

Maxwell Lyte has suggested converting the lead into chloride and electrolyzing it in the molten condition. Crude lead is fused and oxidized by a blast of air in a converter, the oxide is then stirred with hydrochloric acid in earthenware vessels until it is converted into chloride. Any silver compound associated with the lead, salt or oxide treated, is chloridized and is extracted from the mass by the application of strong hydrochloric acid or brine.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

* The arsenic and antimony are oxidized to the maximum and unite with the soda to form scoria.

ELECTRICALLY DRIVEN MACHINERY.

At the 187th meeting of the New York Electrical Society, held on Thursday evening, May 12, in the Concert Hall, Madison Square Garden, Dr. Schuyler S. Wheeler delivered a lecture entitled "Electrically Driven Machinery," a report of which is here given:

"In being called upon to speak, after an interval of a number of years, upon a subject in which I have always been deeply interested, and of which I have been a strong advocate, it is a great pleasure to find in its remarkable progress that my claims and expectations have been more than realized. It is a common saying that electricity has made wonderful strides within the last few years, and I think I need have no hesitation in saying that it is in that department of practical electrical work covered by the subject of this evening that the greater part of this conspicuous advance has been made. A few years ago any suggestion of driving machinery by electric power was received with doubt as to its success; to-day, electric driving is universally acknowledged to be by far the best method, for a number of reasons, and the developing of this new industry has furnished work to keep the electrical factories busy through the past several years of hard times. The savings in the operating expense of factories have been found to be so great that mill owners have purchased electrical equipments in the hardest times as a measure of economy.

"To what is this great success due? It is evident from the rapidity with which electric motors have been introduced, that their advantages must be very marked.

"First, they are capable of direct-connection to the machinery to be operated, which means that their power, however great it may be, and however large the machine, can be transmitted by the shaft instead of requiring a cumbersome belt and a pulley on the driven machine large enough to receive, by the friction of the belt traveling upon it, the needed power. As 1,000 feet of belting one inch wide must pass around a pulley in a minute to transmit one HP., it is evident that the handling of 100 HP. will require a large pulley and a heavy belt, which is not only inconvenient and sometimes dangerous, but occupies considerable floor space and requires that the machine be heavy enough in design to support the large pulley and the strain of the belt.

"Second, motors are capable of regulation and control of their speed and driving power with great convenience, so that electrically driven machines can be started, stopped, reversed or speeded up by the use of small instruments known generally as 'regulators,' which may be placed close to the machine or in any other convenient location, while machinery driven by belting can be merely started or stopped, and then only with a considerable manual effort in shifting the belt, or can be run at other speeds only by bodily removing the belt to a driving pulley of different size.

"Third, motors, when used for driving machinery, are usually attached directly to the machine, and being much less bulky than other means of driving, the entire machine is independent of any line-shafting, and therefore may be located in a convenient position without regard to this limitation, and in many cases can even be picked up and shifted from one place to another as the exigencies of its work require.

"Fourth, electricity permits the saving of $\frac{1}{3}$ to $\frac{1}{2}$ the power otherwise required. This results from the fact that when the tool is stopped the motor is stopped and draws no power, whereas in belt driving when the tool is stopped the belt or one of the belts is simply shifted and continues to run on an idle pulley.

"And last, electricity presents an enormous advantage in the transmission of power. This subject is so large, and has been so well discussed, that I

* For further details of this process, see *ELECTRICITY*, September 8th and 15th, 1897.

† From the *Electrical Review*, London.

will not attempt to add anything to it here, but will give one or two experimental illustrations of what I have already stated. [Illustrations shown.]

"Another illustration is in the use of a motor for operating a lathe. A belt-driven lathe must have a line shaft attached to the ceiling, and the ceiling usually has to be strengthened to support this shaft. It must then be carefully made parallel with this shaft by plumb line and instruments, and then be securely bolted to the floor. A belt of sufficient width to give the necessary friction must be provided, and if the lathe is to be reversed, a second belt, crossed, must be added. The size of the driving pulleys on the shaft on the ceiling must be carefully determined with reference to the pulleys on the lathe to give the desired speed, and then the lathe may be operated provided the line shaft is kept in motion by a steam engine somewhere. But the lathe cannot be moved.

"If the same lathe is provided with an electric motor for driving it, the power may be supplied from any circuit through an ordinary lamp cord, and the lathe may be used in any position. I have here a small engine lathe with a motor built directly on its spindle. The lathe is suspended so as to be swung around in any direction, and will operate continuously while so handled.

"I have one other crude experiment, intended to give an idea of what may be done with an electric drill press, which I will show after describing some views of machinery. The gradual introduction of electric motor driving on machinery has, of course, led to such modifications in the design of machinery as would naturally follow from the differences between belting and motors. I mean, for example, since the motor is small and can be built into the machine close to the cutting tool, or the part which uses the power, that all shafts, gearing, wheels, etc., within the tool, which have been heretofore necessary to receive the driving belt and transmit its power to the tool, may be dispensed with, and then the frame of the machine may be made a different shape, or much lighter, since it does not have these additional parts to support. The attitude of the manufacturers of machinery, during the last five years, who are of course conservative and not stimulated by the interest and confidence in the future of electricity that the electrical men felt, has been interesting. At first they said they supposed their machines could be operated by a motor if the thing would run, and that the purchasers of their machines might try it, but they would take no responsibility. Then they gradually became willing to furnish their machines with brackets and other parts for the ready reception of the driving motor, and now they are anxious to cultivate the electrical trade and to co-operate with its members in bringing out simplified designs of machines with motors incorporated.

[The lecturer here exhibited a number of views of machines combined with motors some of which were of machines especially modified in their construction to suit the new method of driving. He also presented experiments in further illustration of the extreme portability of electric tools, and illustrated the methods now actually in use in shipyards for attaching drills and other tools to the sides of ships.]

"In conclusion, I can think of no stronger or more flattering evidence of the success of electric power as a new industry than the fact that large quantities of American apparatus are now being installed on American plants and according to American methods in other countries, and there are to my knowledge alone at the present time in this country half a dozen engineering representatives of English manufacturers, studying what we have done, and finally leaving orders with us. So that those of us who are not wanted in more aggressive fields of operation at the present time are at least able to contribute for our country an industrial victory."

ELECTRICITY IN THE HOTEL AND HOME.

A Frenchman who appears to have been astonished at the luxurious accommodations he found in the more recently erected hotels and residences in New York has inspired some one to write a very spirited description of the furnishings of some of these palatial establishments which we find in the Philadelphia *Inquirer*. Special prominence is given to the elevators:

Little boudoirs on wings is the appropriate description given by an enthusiastic Frenchman of the elevators he found himself invited to enter on arriving in any of the new and sumptuous houses of his American hostesses. In fact, so agreeable an impression did these lifts have on his receptive appreciative Gallic mind that he is going back to Paris to preach the benefits the elevator will confer in the tall French houses. So far in Paris there is but one of these conveniences known, and that has been recently fitted into the splendid town residence of the Countess Castellane. In the great houses of our American millionaires the elevator is becoming the rule and not the exception, especially so at Newport and in New York City, where a foot of land is worth a small fortune, and the houses are rearing their heads more loftily every year.

The exceeding usefulness and beauty of the private lift has never been more clearly demonstrated than in the great Astor mansion on Fifth avenue, in New York City, especially when an elaborate entertainment is in progress. Now one of the chief beauties of this admirable dwelling is the grand staircase, that sweeps up from the very doors of the marble vestibule to the great hall opening on to the picture gallery. At night when palms and candles shed alternate light and shade along the crimson carpet, silver rods and carved balustrade, this is the very choicest spot on which to gracefully display gorgeous toilets. Therefore, when the women in their wraps and fur boots are set down under the porte cochère, they are led to one side of the vestibule, a grilled door slides back and six at a time are ushered into the snugest little lift ever seen.

Its floor is covered with a velvet carpet of the warmest cerise tone, and being octagon shaped, four of the sides are made of plate glass mirrors framed in gilt and four sides of panels of tufted cerise satin. All the elevator's roof is built of gilded iron, wrought in odd shapes and partially filled in with rose-colored glass, over which a spray of electric lights springs. By this device the interior of the living room is filled with a tender becoming glow that every woman keenly appreciates, as she does also the six comfortable seats the lift contains and the fact that she was saved the necessity of parading in her wraps like a chrysalis up that splendid stairway.

A solemn young man in powdered head and court livery guards the electric lever and the travelers in the elevator, all of whom are landed on the third floor. There they are ushered into a dressing-room, wraps are removed, toilets touched up, and the charming butterflies are ready to meet their male escorts and join the gay procession moving down the great stairway.

Of course, it all depends upon circumstances whether the private elevator shall be a costly or inexpensive addition to the modern house comfortable. Since electricity has come so rapidly into use as a domestic servant for lighting and heating, a small lift, capable of holding three persons, can be fitted into any house at an outlay of about \$300. It is manœuvred by a touch on a button, and is safe indeed. No elaborate interior decorations come for this price, as for instance will be found in the exquisite little basket affairs that some women use in journeys from floor to floor of their home. These are wicker lifts, and hold but the owner and a couple of friends.

On stepping inside a wicker lift, the sensation is of having entered a gorgeous, gigantic waste-paper

basket. The walls are of rattan treated with gilding and enamel paints, the floor covered with a white goatskin rug; against the broad seat upholstered in delicately tinted china silk, pillows are heaped, and the roof is a prettily woven dome of wicker, with a cluster of electric lights falling from the center.

In the rear of the majority of new houses one large lift is arranged for the service of the domestics, and to carry up the coal, luggage, etc., and the tiny affair used by the mistress runs in a shaft that extends from the cellar to the garret. By this means she is able every day to go over every floor in the house if she is so minded.

At regular intervals these private lifts are all most carefully inspected, and though among the wealthy their contribution to comfort is invaluable, it is the women of moderate means who find the growing popularity of the little elevators absolutely destructive to their domestic peace. Not a whit less luxury loving than the mistress is the American servant, who, having once lived in a house where the stairs are scarcely more used than the fire escapes, not only resent, but flatly refuse to hire out in what they call the old-fashioned inconvenient homes. This complication as much as anything else has forced the fitting up of lifts in dwellings, the humble-minded owners of which believed until recently were the very models of domestic luxury.

LONDON NOTES.

[From our London Correspondent.]

Institution of Electrical Engineers.

Before this Institution on Thursday, April 28, a paper on "Earth Returns for Electric Tramways" was read by Mr. H. F. Parshall, and some joint notes on electric tramways by Major P. Cardew, R. E., British Board of Trade, and Mr. A. P. Trotter, Cape Colony Government Electrician. The idea of these papers being read on the same evening appears to have been to raise a general discussion. Mr. Trotter's notes contain a neat graphical method for determining the fall of potential in the return with uniform distribution of current, and the proper points of application of return feeders. Major Cardew contributed a note prepared by him in May, 1894, and sent to the South Staffordshire Tramways Company, advocating the automatic regulation of this fall of potential. Each of the papers was illustrated by means of curves and diagrams.

Cork Electric Tramways.

A combined electric lighting and tramway plant which was commenced in November last for the city of Cork, Ireland, is approaching completion. The lighting part of the work is to start operations the present month and the tramways are expected to start running a month later. There is about 11 miles of tramway track of 3 feet gauge, the rails being 83 lbs. to the yard, and the lighting consists of 94 constant potential arc lamps which are mounted on the top of the trolley poles used for the overhead wire work. Current for lighting is distributed on the three-wire system, with 440 volts across the outers, consumers' supply being 220 volts. For the tramways, side brackets are used for single track and double arms where center poles are employed for double track. The power plant includes three Babcock & Wilcox boilers, each of 2,531 square feet heating surface and capable of evaporating 8,000 lbs. of water per hour, three McIntosh & Seymour side crank tandem compound engines directly connected to 200-kilowatt generators, running at 150 revolutions per minute. In the battery room are 256 Tudor cells, capable of discharging at 110 amperes for 7 hours. A booster of suitable capacity regulates the charge of the cell. The switchboard consists of a combination of lighting and railway panels, the same machines being interchangeable in railway and lighting service. There are to be 18 double-decker cars. They will each carry 44 passengers and be fitted with double motor equipments and series parallel controllers.

WHAT ELECTROLYZED SEA WATER HAS ACCOMPLISHED.

BY W. L. HEDENBERG.

The problem of finding an economical and efficient method of purifying and disposing of the sewage from a community would seem to be growing each year more difficult to solve.

A century or so ago when the first settlers were pushing inland they naturally avoided arid districts and located whenever possible on the banks of some stream. There were two causes which led to their so doing. The land was usually found to be more fertile in such localities, and the population had to rely in those early days almost entirely on water for transportation. As the country developed and the population increased, towns and cities gradually sprang up where formerly settlements had been.

From the beginning all waste matter and refuse was naturally thrown into the neighboring stream as the easiest and quickest method of disposal, and there was no apparent harm in so doing while the settlements were small and scattered. When, however, these communities became good-sized towns or small cities located within a few miles of one another, all discharging their waste into the stream and at the same time drawing their water supply from the same source, diseases and epidemics began to be prevalent.

To remedy this state of affairs and improve the public health, the proper authorities justly insisted on the sewage being at least partially sterilized. There were a number of ways in which this could be accomplished more or less satisfactorily, depending on the thoroughness of the process. Recourse was usually had to mechanical filtration, land filtration, chemical precipitation or to a combination of these methods. Recently, however, two other processes have made their appearance. These latter consist in mixing a disinfecting liquid, obtained by passing a current of electricity through sea or salt water, with the matter to be sterilized.

These two methods, one invented by Mr. Albert E. Woolf in this country, the other by M. Hermite in France, are essentially alike and differ only in their method of application.

Probably the first attempt to sterilize a polluted water supply by the Woolf process was at Brewsters, New York, in the summer of 1893. An electric plant was installed for the purpose, consisting of a 15 horse power engine and a dynamo capable of generating a current of 700 amperes at a pressure of 5 volts. A vat of 1,000 gallons capacity contained the electrodes, which consisted of a platinum zinc couple, the platinum electrode being made up of a copper core with a platinum coating .003 inch in thickness.

The disinfecting liquid which Mr. Woolf calls electrozone was then obtained by circulating sea water through the tank containing the electrodes. This antiseptic was in the experiments at Brewsters allowed to flow into the sewer which emptied into a marsh from which the water supply was taken, and was also sprayed into what is known as Tonetta brook, in the proportion of one part hypochlorite to 100,000 parts of water.

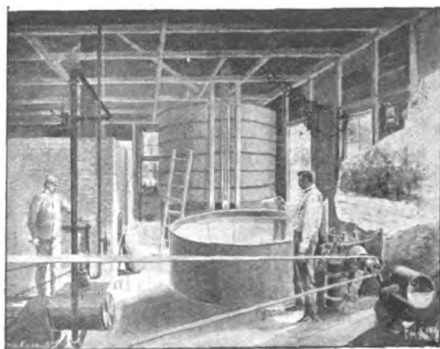
The results obtained by this process from a bacteriological standpoint were exceedingly striking and attracted wide attention. The worst sample of water examined by the New York board of health at the time showed the presence of 22,000 bacteria per cubic centimeter before treatment and but 42 after having been mixed with electrozone in the proportion previously mentioned.

Owing to the striking results obtained at Brewsters Mr. Woolf was shortly afterwards called upon to disinfect Riker's Island, at that time the dumping-ground for a large portion of New York's garbage. This tract of land, comprising some 137 acres, was fast becoming extremely offensive under the heat of a summer's sun, and numerous complaints

made by citizens residing in nearby sections of the city made it imperative that some action towards remedying this public nuisance should be taken.

In June, 1894, therefore, Mr. Woolf installed an electrozone plant on a barge which was towed to Riker's Island and which was capable of generating 4,000 gallons of disinfecting liquid per hour. By means of a 15-horse-power pump the electrozone was distributed through lines of hose to various points where it was sprayed upon the decomposed garbage. In a comparatively short space of time this method of procedure wrought a great change. The obnoxious odors, which formerly could readily be detected at a distance of several miles under favorable atmospheric conditions, were scarcely noticeable a hundred yards distant.

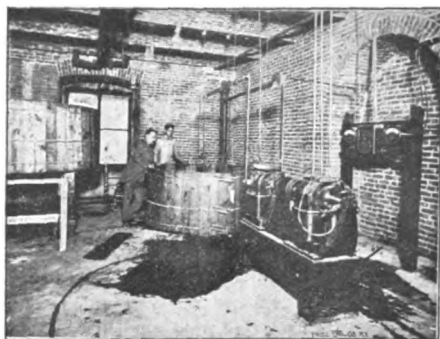
The Woolf process was next tried at Danbury, Conn. The plant consisted of a 40-horse-power engine and a dynamo giving a current of 1,000 am-



PLANT FOR THE DISINFECTION OF SEWAGE AT BREWSTERS, N. Y.

peres at a pressure of 5 volts. In this case it was desired to purify the sewage before discharging it into the neighboring river. The disinfectant was generated in a vat situated above a large tank through which the sewage flowed. The electrozone was made to flow by gravity from the upper to the lower tank, a thorough mixture of the two liquids being effected by means of an agitator. As the mixture rose in the lower tank it overflowed into a line of pipe which discharged into the neighboring water-course.

This plant, according to the opinion of the citizens of Danbury, scarcely accomplished the desired purpose, although the analytical results were exceed-



DISINFECTING PLANT ERECTED BY THE BOARD OF HEALTH, PHILADELPHIA.

ingly good. The objection arose owing to the fact that the heavy part of the sewage was allowed to find its way into the stream, which was considered a public nuisance by persons living along the shores. The writer has suggested elsewhere* a means whereby this objectionable feature could in all probability have been remedied. However after considerable litigation the Woolf process was ultimately abandoned at Danbury for a more expensive method of sewage purification.

The Hermite system, which has been experimented with abroad even more than that of Mr. Woolf in this country, differs from the latter, as previously stated, only in a few minor details in the

production of the disinfectant and in the method of application, which can partly be accounted for in the widely different sanitary arrangements existing in Europe and in this country. For instance, M. Hermite recommends the use of his disinfecting liquid as ordinary water in all lavatories, and seeks in this way to thoroughly sterilize household wastes before they are admitted to the public sewers. In other words, a complete and separate system of piping is necessary. This method of procedure and general arrangement was probably thought necessary owing to the fact that in most European cities the drainage systems are of the combined type, admitting both rain water and sewage. The sterilization of this amount of liquid, especially during a rainy period, would undoubtedly be a very costly undertaking.

The negative electrode in the Hermite system is composed of disks of zinc which when in operation revolve. The positive electrodes consist of glass tubes covered with a coating of platinum, one being located between each pair of zinc disks. The electrodes are usually enclosed in an iron tank connected with a perforated pipe at the bottom through which the electrolyte, consisting of sea water, enters. This system has been tried as a sanitary measure more or less extensively at Havre, Brest, Nice, Paris, Lorient, Monte Carlo, Worthing, Ipswich, and more recently still at Bombay, India.

Probably the experiments at Brest were on the most extensive scale, the sewage of 11,000 persons being treated. The results were apparently satisfactory, as an official report issued by Dr. Pitan and dated Feb. 21, 1894, says: "In a word the experiments which I have made enable me to conclude that electrolyzed sea water is a perfect disinfectant and an excellent antiseptic which very rapidly destroys all microbes, even the most tenacious of life, on the condition that these microbes are brought into contact with the electrolyzed sea water."

The plant at Ipswich* in England seems also to have given fairly good results for what it was intended, it merely being desired to arrest the decomposition of the sewage until it could be carried out to sea. On the other hand the results obtained at Bombay could scarcely be called satisfactory.

The principal objections to both the Woolf and Hermite disinfecting processes would seem to be the fact that the deodorizing fluid is unable to penetrate through the solid portions of the sewage, as was clearly proven by the use of electrozone at Danbury. The disinfectant apparently sterilizes the outer surface of the heavy matter, but leaves the inner portion to decompose and breed disease germs. This defect might possibly be remedied by the use of some form of crusher or beater that would tend to disintegrate the solid portions of the sewage.

As a sterilizing agent for town wastes, electrolyzed sea water has therefore been adopted but slowly in spite of the low cost of this method, and it will be necessary to remedy the serious defect previously mentioned before it can hope to be widely made use of by large communities.

CANADIAN NOTES.

The town of Lindsay, Ont., is to have a new electric light company. The water power to operate the company's plant is to be supplied from the village of Fenelon Falls which is sixteen miles distant from the town.

The representatives of the Toronto city council visited Niagara Falls for the purpose of inspecting the electric power works which have been established on the American side by the Niagara Power Company. Questioned regarding the possibilities of transmitting power to Toronto, Mr. W. B. Rankin, manager of the company, stated that the loss in transmission to Buffalo was 12½ per cent., and a further loss of 6 per cent. was incurred in distribution in the city. What the loss would be in the longer distance to Toronto he did not know, but the electrician of the company estimated that it would be at least 25 per cent.

* For detailed description see article by Mr. J. B. O. Kershaw in *ELECTRICITY*, April 6, 1898.

EFFECT OF THE WAR ON GENERAL INDUSTRY.

The well known banking firm of Henry Clews & Co., New York City, in their Weekly Review publish the following over Mr. Clews' signature. It is dated May 14:

"It is now nineteen days since the declaration of war with Spain. Under ordinary conditions, the beginning of hostilities upon a large scale and with imperfect preparations might be expected to create disturbances of confidence and serious prostration in all our markets. This is no more than has been common in the experience of other nations. But, in our case, war has thus far been attended with a marked recovery of confidence in finance and a revival of activity in trade. The Government is devising plans of heavy taxation and considering the authorization of large loans; but the country finds in all this no reason for contracting its industrial operations, the people no necessity for reducing their expenditures. Labor is well employed, and there is no shrinkage in values to indicate a falling off in demand, but rather a general firmness in the commercial markets and, in some, a material advance in prices. Nor is this rise in values due to any interruption of supplies from other countries, for the Spaniards have so far been unable to check the current of our imports.

"The state of feeling in the financial markets surpasses the most sanguine expectations. In anticipation of the war there was some anxiety among the lenders of capital, which showed itself in a material contraction of the loans of the metropolitan banks and a disposition among the interior banks to draw home deposits from their agents in this city. Money on call was cheap, but only because there was an indisposition to employ it on time loans or discounts. Within three short weeks all this is changed. From the interior all reports show a settled and confident feeling, and currency is flowing hither from the subsidiary financial centers. The note brokers of this city, which in April found it almost impossible to secure buyers for their paper, are now able to dispose of it in about the normal volume. The city banks are discounting quite freely and have reduced their rates on time loans by $1\frac{1}{2}$ to 2 per cent. In brief, credit operations have resumed their normal course. New enterprises, requiring large investments of capital, which have been held in suspense for many weeks in view of the possibilities of war, are now coming to the front again, and bankers in the flotation business seem to be quite hopeful of the prospect of investors supporting meritorious undertakings.

"In the Stock Market the reaction from the ante-war depression exceeds all expectation. In anticipation of the war, the question was not so much whether prices would advance under the influence of hostilities as whether they would not suffer a still further decline.

"Upon 17 active stocks, the rise since the opening of hostilities has averaged about nine points; nor does the upward movement appear to have yet exhausted itself.

"The extraordinary course of things expressed in the foregoing facts deserves to be considered in estimating the probable future course of the securities market. It plainly shows that the possible depression and stagnancy which was deemed possible in anticipation of the war has not been realized. That fact is full of weighty significance. It demonstrates how much Wall Street has learned in the way of estimating complex and disturbing situations since the silver crisis of 1896; how much it has gained in clearness of judgment and in courage to act upon a common sense conviction. It proves that the men of finance have learned where to fix the limit to the legitimate effect of events disturbing the normal current of business. And above all, it shows that Wall Street has, at last, learned the much needed lesson that it needs much more than transient troubles, than even such a war as we have undertaken, to

warrant a surrender of confidence in the steadiness of the vast machinery of production and wealth which constitutes the material greatness of this foremost of all nations. It has taken a war to teach us how much shock and how much sacrifice the United States can stand without suffering or real occasion for winning. The whole cost of the war is a cheap price to pay for this inestimable lesson. It is the greatest contribution to the stability of public confidence and to trust in our commercial and financial framework that has been forthcoming in the history of the country.

"Although, in war movements, there has been an interval of absence of conspicuous exploits, yet preparations are in progress which, at a little later stage, promise great if not decisive results. The Spanish fleet is at last within our easy reach; and, within two or three days, we may witness the great naval conflict which is likely to put an end to the war. So far, our operations have elevated the world's respect for our material resources and left but one opinion as to the final, if not early, outcome of the struggle. Expressing my view in genuine Yankee phrase and spirit, I should say that American citizens have enhanced in the world's valuation at least 50 per cent. through the result of the American-Spanish war, and everything American will appreciate in the same ratio after the war is over. Admiral Dewey marked up American history over 100 per cent. by smashing the Spanish fleet and at the same time silencing Manila's guns in the short, sharp and effective way he did it. It was the American way of doing it, you know, and not Spanish. We can take Manila, Cuba, Porto Rico, the Canary Islands, and bang the Spanish coast all to pieces whenever we want to. We have the naval commanders; we have the gunners; we have the sailors; we have the ships; we have the pluck; we have the skill; we have the weapons; we have the food supplies, and we have the money too to back us all the way through. What, therefore, is the use of Spain pretending to fight such a foe? It is simply an evidence of imbecility."

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Special Rates To and From Chicago.

We have received the following notice for publication from Mr. C. O. Baker, Jr., Master of Transportation, 136 Liberty street, New York:

"The Trunk Line Association, Central Traffic Association, New England Passenger Association, Southern Passenger Association, and the Western Passenger Association have granted a rate of a fare and one-third, on the certificate plan, from all points in their territory to Chicago and return, for delegates attending the Twenty-first Convention of the National Electric Light Association, to be held June 7, 8, 9. Convention hall and headquarters at the Auditorium Hotel; rates—\$3.50 to \$5 per day on the American plan, \$2 to \$4 per day on the European plan, for each person."

The Electric Plant at West Point Academy.

The Government specifications for the supplies necessary for the electric plant at West Point Military Academy contain the following items:

Five doz. cells of Klondike batteries complete, without sal ammoniac; 5 doz. cells of non-polarizing dry batteries, 3 doz. b., 2 doz. c.; 1 doz. Wilhelm double diaphragm transmitters with induction coils and binding posts; 1 doz. Wilhelm telephone receivers; 1 doz. 3-inch iron box bells, nickel-plated; $\frac{1}{2}$ doz. Allen soldering sticks; 1,000 lbs. No. 8 soft iron wire, galvanized; 40 lbs. 18-gauge annunciator wire; 100 lbs. Okonite wire; 6 lbs. Grimshaw tape; 12 lbs. fuse wire; 4 pairs stub pliers; 2 pairs wooden blocks, double sheared; 1 pair Welden climbers; 3 pairs M. Klein & Son's splicing clamps; 1 Klein & Son's tape upreel, Manhattan Electric Co., or equal; 1 lineman's testing magneto bell, 25,000 ohms; 1 magneto generator, 25,000 ohms; 1 Vulcan gasoline torch; 2 Whitney hand drill outfits, with drills; 8 24-inch wood brace drills; 2 eccentric clamps; 150 ohms relay; 1 6-inch skeleton bell; 25 yds. twin wire cord, for telephone switchboard, green, and 2 lbs. white vaseline.

SOCIETY NEWS.

American Institute of Electrical Engineers.

The 15th Annual Business Meeting of the Institute was held at 12 West 31st street, New York, on Tuesday evening, 17th inst. At the close of the meeting, which was brief and given up wholly to business matters, several of the members attended the Electrical Exposition.

Applications were received from the following candidates for associate membership, and will be acted upon by the council at its meeting June 22 next:

Walter C. Allen, Washington, D. C.
Frank Henry Dexter, Ithaca, N. Y.
P. M. Downing, Blue Lakes City, Cal.
Joseph Lyons, Washington, D. C.
George A. Damon, Chicago.

The 15th General Meeting will be held at Omaha, Neb., June 27-29, 1898.

The New York Electrical Society.

The 187th meeting of the New York Electrical Society was held in the Concert Hall at Madison Square Garden on the evening of the 12th inst. The meeting was more than ordinarily interesting because of its close connection with the Electrical Exhibition, then in full swing in another part of the building, and of which the Society is the foster mother. The lecture by Dr. Schnyler S. Wheeler, which will be found on another page, was also an attractive feature. At the business meeting which preceded the lecture the following new members were elected:

Ernest B. Laclain, C. C. Bohn, W. G. Ames, E. M. Saules, Frank A. Wunder, Albin Gustafson, Charles J. Klein, Chester Bayles, James Jones, Jr., F. W. Becker, D. Levy, Richard M. Beard, E. A. Quick, Reinhold H. Wappler, Edward Hyans, George M. Loos, P. H. Klein, E. R. French, J. E. Sayles, James H. Spencer, J. D. Gould, Chas. A. Hanson, C. W. Price, Lucien W. Jenney, P. M. Mourey, Walter S. Levin, Benj. O. Ellis, H. D. C. Richards, C. B. Sterling, D. S. Holcomb, Chas. E. Dressler, M. C. Rorty, Chas. W. Hoffman, Willard S. Bennett, Charles Fred, Many Fred, A. H. Mustard, Harold A. Tileston, Oscar F. Ehrle, Wm. Aus, Elias E. Ries, W. J. Newton, John Barry, Thos. S. Jamieson, S. Clark Harris, R. J. Mulligan, V. J. Mayo, T. W. Kloman, Warren A. Brown, Harry Hilbert Conner, Hugo G. Freund, A. S. Brown, J. Henry Gill, Daniel Von Wien, M. Cushman, John Jacob Astor, Mortimer Nordon, Chauncey M. Depew, L. W. Hildberg, Saml. B. Brewster, George Pugh, Emil Finger, Jos. Solot, Chas. Penina, Francis Gans, Gottfried Gans, Howard D. Black, William Wilson Lightipe, W. M. Logan, Jos. B. Curran, E. R. Esmond, John McLean, Frank W. Hawley, Cyrus O. Baker, A. O. Schoonmaker, W. C. Burton, R. Hoyt, J. E. McConnell, all of New York City.

H. Krantz, Jos. Albaum, Sol. S. Sugar, A. T. S. Clarke, Fred'k W. Schnelle, A. T. Welch, John C. Lott, all of Brooklyn, N. Y.

Harry Hunter, Far Rockaway, N. Y.

E. T. Schoonmaker, Fordham, N. Y.

E. N. Corbin, Walton, N. Y.

Chas. R. Barnes, State Electrician, Rochester, N. Y.

J. Henry Gill, Chas. H. George, Orange, N. J.

Jas. MacMaster, Elizabeth, N. J.

Wm. Darrow, Jr., Summit, N. J.

W. D. Macdonald, Hudson Heights, N. J.

Fred E. Dolbear, Elizabeth, N. J.

W. M. Allen, New Brunswick, N. J.

J. C. Jones, Ampere, N. J.

G. R. Berger, Newark, N. J.

Frank M. Tait, Catasauqua, Pa.

F. L. Meyer, Philadelphia.

Garrett A. Hobart, Jr., Washington, D. C.

George W. Vanderbilt, Asheville, N. C.

M. J. Wightman, New Brighton, S. I.

LEGAL NOTES.

The suit which was brought by the city of New York to decide the rights of the Metropolitan Street Railway Company on Sixth and Eighth avenues, through which a division of the Metropolitan extends, has been closed by the decision of the Circuit Court of Appeals affirming the judgment of the lower courts, who held that the Metropolitan Company was justly entitled to the privileges which it enjoys on the two avenues.

Judge Gordon in Court No. 3 at Philadelphia on the 12th inst. appointed Walter E. Rex receiver of the Holt Electric Storage Company. This action was taken upon a bill in equity filed by William S. Perot, Jr., against the storage company, in which he alleged that the company was insolvent and has ceased to transact business. In its answer the company stated that the allegations made in the bill were true, and joined in the request that a receiver be appointed.

Judges Colt, Brown and Lowell in the United States Circuit Court of Appeals, Boston, on the 11th inst., heard the complainant's appeal in the case of Hart & Hegeman Manufacturing Company vs. the Anchor Electric Company et al. from the decree of the Massachusetts Circuit Court dismissing its bill. It asked for an accounting, and an injunction to restrain the defendants from the alleged infringement of patent No. 11,395, reissued to G. W. Hart on December 12, 1893, for electric snap switches used in making and breaking circuits for electric currents. The court reserved its decision.

Dr. Louis F. Praeger, Brooklyn, N. Y., obtained a verdict of \$15,000 damages against the Brooklyn Heights Railroad Company in the Supreme Court on Friday last for personal injuries received in a trolley car collision in September, 1896. His spine was hurt, causing, as he alleged, permanent injury.

In the Superior Civil Court at Salem, Mass., on the 4th inst., the jury in the case of Charles Melanson against the Thomson-Houston Electric Company of Lynn returned a verdict for the plaintiff in the sum of \$6,242. This was an action to recover for the loss of three fingers of the right hand, the injury having been sustained while operating an alleged faulty machine.

Proposed Increase of Examiners in the U. S. Patent Office.

The patent laws of the United States are receiving considerable attention in the present Congress, and a number of bills amending them have been introduced. The Patent Office has been a potent factor in developing the industries of the country, especially the electrical industry, and the laws governing it have not been perfect. It is hoped that out of the many suggestions offered there will come enactments which will place on our statute books laws which will enable the Patent Office to work more effectively and with a much more careful scrutiny of and guardianship over the rights of inventors.

In this connection it is of interest to note that the Platt bill for revising and perfecting the classification of letters patent and printed publications in the Patent Office has passed the Senate and is now pending in the House with an excellent chance of soon being enacted into a law. The bill carries with it an appropriation sufficient to provide for three additional principal examiners, two first assistant examiners, two second assistant examiners, six third assistant examiners, and five fourth assistant examiners. With this increase in the working force, the work of the office, which is now greatly in arrears, can be brought more up to date.

Our contemporary the *Western Electrician* has removed its New York office from 108 Times Building to 809 Postal Telegraph Building. Mr. Robert J. Parvin is the manager.

THE NEWS.

What Is Going On in the Electrical World.

STREET RAILROADS.

Anderson, Ind.—The Union Traction Company, constructing the gas belt electric railway, has closed a deal for a line from Alexandria to Elwood, connecting with the Anderson-Marion line. This makes the electric road a rival of the Panhandle and Lake Erie as well as the Big Four.

Atlantic City, N. J.—A meeting of capitalists was held here on the 11th inst., when the temporary organization was effected of an electric railroad company which proposes to build a railroad across the State from Camden to this city, to be operated by electricity. The capital stock is \$600,000. J. J. Patterson, of Philadelphia, was chosen president and A. C. Welhouse, of Lancaster, Pa., secretary.

Bloomington, Ill.—By decree of the court the Bloomington City Railway is to be sold on May 31.

Cedar Falls, Ia.—C. W. McElysa has sold the Cedar Falls and Normal Street Railway to a local company for \$25,000.

Cincinnati.—Judge Taft has granted the motion asked for by the first mortgage bondholders of the Louisville Trust Company, confirming the sale of the Cincinnati Inclined Plane Railway to Charles H. Kilgour for \$278,000. The court also orders Receiver Brent Arnold to deliver the property to the purchaser upon the execution of the deed.

Des Moines, Ia.—The six months' experiment of having letter boxes attached to the street cars, which has just expired, has proved a success. Based upon the results of the experiment the street cars in Des Moines with the letter-box attachment would handle in a year 400,000 pieces of first-class mail and 70,000 pieces of second-class mail. The street-car companies will demand compensation from the Government if the system is to be continued.

Kansas City, Mo.—The "Star" states that Charles Francis Adams of Boston, P. A. Valentine of Chicago, C. F. Morse and W. H. Holmes, directors of the Metropolitan Street Railway Company, who represent more than two-thirds of the stock in the company, decided at the recent conference to spend a quarter of a million dollars in changes and improvements on the Metropolitan system this year.

Libertyville, Ill.—The village board has granted a franchise to E. C. Weeks and associates, who propose to build an electric road starting at Libertyville and continuing to the "chain of lakes" in northern Illinois and southern Wisconsin.

New Haven, Conn.—A long contest between the Bridgeport Traction Company and the New Haven Railroad Company has ended in the success of the former corporation, whose application in regard to grade crossings in Bridgeport has been granted by the Railroad Commissioners. The decision provides, however, that the crossings shall be made at the trolley company's cost, that they shall be of an improved character, that trolley-cars must stop before crossing, and that there shall be an improved system of signals.

Peekskill, N. Y.—The Peekskill Traction Company has asked the village trustees for a franchise to build and operate an electric railway on several streets in the village.

Plymouth, Mass.—The new Plymouth & Sandwich Street Railway Company has been organized, and the special charter granted by the Legislature has been accepted. A survey is soon to be made to determine the best location, and the probabilities are that a section, as far as Manomet Bluffs, will be built at once even if the whole line is not undertaken. Subscriptions for upwards of \$10,000 worth of stock have been made.

South Berwick, Me.—The Dover Street Railway Company, in conjunction with Portland capitalists, has purchased the Hale cotton mill at South Berwick, which has a valuable water power that will be utilized in the operation of an electric road to be constructed from South Berwick to Dover, N. H. This will complete an electric circuit connecting Dover, Somersworth and South Berwick.

Standish, Mich.—A railway project under consideration is the building of an electric line to Point Lookout, in Arenac county, which is becoming well known as a summer resort. The proposed road would connect with Standish, Au Gres and Omer.

St. Paul, Minn.—The board of aldermen has passed an ordinance authorizing the St. Paul City Railway Company to construct and operate an interurban line through Como Park. The line is to connect St. Paul with Minneapolis.

Toledo, O.—The "Blade" says: "Parties interested in a proposition to build and equip an electric railway line between Toledo and Detroit will do well to proceed with caution. It comes from direct sources that the executive board of the Vanderbilt interests has for some time been desirous of converting one of the two lines now running between the two cities into an electric road, and using the other as a freight line. This has been opposed personally by Mr. Vanderbilt, who recently announced, however, that should outside parties

undertake to build a line he would immediately agree to the wishes of the board, and favor a prompt equipment of one of the two existing lines as an electric road, and competition would be made so sharp that an independent line would have very rough sledding."

Uniontown, Pa.—The Uniontown Electric Railroad Company has decided to build an extension to Stewart coke plant, Cool Spring Hollow. The branch will connect with the park terminus and will be extended on to Lemont and Youngstown this season.

LIGHTING PLANTS.

Chicago.—The Cicero Light & Power Company's plant was totally destroyed by fire on the 7th inst. The loss is about \$50,000. The company furnished light for Austin, and divided the western territory with the Cicero Water, Gas & Electric Light Company.

Fenton, Mich.—The sale of the Fenton electric light plant to Fayette L. Thompson, for \$7,000, by Receiver C. L. Tinker, has been set aside by Judge Wisner.

Lawrenceburg, Ky.—The franchise and contract for lighting the city with electric lights has been awarded to Geo. W. Dyer of Princeton, Ky., who promises to complete his plant within four months. Eighteen arc lights of 2,000-candle power each are to be used.

Lansdale, Pa.—The proprietors of the Lansdale Electric Light Works and the borough council have closed a contract whereby the light company sells to the borough its entire plant and franchise for street and commercial lighting for \$4,000.

Sidney, N. Y.—At the special election in this place for the purpose of voting on the proposition to raise \$1,540 per year for five years for lighting the streets with electricity, the proposition was carried by an almost unanimous vote.

Springfield, Minn.—The council has decided to put in a new system of electric lights here at once. The change is made necessary by the defective condition of the present system. A complete incandescent system will be put in.

St. Albans, Vt.—The bill permitting this city to issue bonds to the amount of \$150,000 having become law, Mayor Smith has had the necessary papers prepared for acquiring a water power, lands, rights of way, etc., and to construct, maintain and operate an electric light plant.

Watertown, S. D.—A committee of the council has been making investigations looking to the erection of an electric lighting plant in Watertown.

MANUFACTURING, ETC.

Albany, N. Y.—J. E. Powell, U. S. Government electrical inspector, has made examination of the Federal building in this city with a view to changing the system of lighting, and will report to Washington. The old elevator in the building is to be removed and a new and improved one put in.

Chicago.—The American Electrical Works of Providence, R. I., with a capital stock of \$500,000, has been licensed to do business in Illinois with a capital stock of \$10,000.

Detroit, Mich.—The Detroit, Lake Shore & Mt. Clemens Railway Company has closed a contract with the Siemens & Halske Company of America for two generators and a switchboard, amounting to \$14,500.

Denver, Col.—The Walker Company of Cleveland, O., has decided to more fully occupy the Colorado field for electrical appliances, and with that end in view has appointed W. H. Emanuel, the well-known dealer in mining machinery, as its Denver agent.

Miami, O.—The Maumee Valley Railroad Company intends to erect a plant here to furnish power for all the cars on the belt. The new plant will cost about \$38,000.

Portland, Me.—The Portland "Advertiser," in noticing the erection of an electric steel conveyor for the Maine Steamship Company by the Belknap Motor Company pays a high tribute to that company's electrical engineering work.

Washington, D. C.—United States companies engaged in the manufacture of electrical apparatus have been called upon for the installation of a plant in paper works in Brazil and for a large equipment for the San Rafael Mills in Mexico. At San Ildefonso, near the City of Mexico, a plant built by United States manufacturers, with a capacity of 1,000 HP, is soon to be inaugurated. In addition to those named, a number of other modern plants have been and are to be soon established in Mexico. Valparaiso, Chili, has invited bids from several United States companies for establishing a general electric lighting and power plant in that city.

TRANSMISSION PLANTS.

Tacoma, Wash.—The Snoqualmie Falls Power Company has made application to the council of Tacoma for the right to distribute electric power for lighting and manufacturing purposes in the city. The city fathers and county commissioners, who made a trip to the falls, were much impressed with the possibilities of the proposition, the falls being sufficient to generate power enough to drive all the machinery, furnish all the lights and run all the street cars in both Tacoma and Seattle when once the plant, now in process of installation, is completed.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—Open competitive examinations for merit will be held June 4 in the various cities throughout the State for applicants for various State and department positions, among others chief electrical engineers.

Rensselaer, N. Y.—Willard F. Bowen, engineer at the Kinderhook Light & Power Company's house, was injured a few days since by an electric shock. His condition is serious.

WAR WORK OF THE ELECTRICIANS.

Schenectady, N. Y.—The "Union" says the organization of a volunteer brigade of engineers to number 3,500 men, regularly enlisted and commissioned in the service of the United States, is progressing rapidly under the supervision of Captain Eugene Griffin, First Vice President of the General Electric Company. The proposed brigade is to be composed of three regiments, comprising civil, mechanical and electrical engineers, artisans, draughtsmen and men familiar with all kinds of engineering work. Captain Griffin has received so large a number of letters and offers of service from prominent mechanical, electrical, civil and military engineers throughout the country as to make it certain that there will be no difficulty in organizing the proposed brigade with picked men. Special legislation authorizing the organization of a brigade of engineers from the nation at large is now pending in Congress, and will probably be enacted into law this week. In the meantime, however, it is understood that Captain Griffin is organizing one regiment of engineers at the request of the Secretary of War, which regiment can be afterwards expanded into a brigade when the law permits the organization of such brigade. Speaking of his project to a representative of the "Union," Captain Griffin said: "Like the engineer troops of all armies, the proposed engineer brigade will be armed and drilled as infantry and would be quite ready to take its place in the line of battle in case of necessity. The record of our engineer troops in the last war, and good work done on the line of the Fifth Corps in the Battle of the Wilderness and in other places, shows that the higher technical skill and training exacted of the engineers detract in no wise from their fighting capacity. The fact that they must be drilled as infantry, in addition to the necessary technical instruction and training, makes it especially imperative that the volunteer engineers should be among the first troops to be organized, to the end that time may be given for them to reach the highest possible state of efficiency."

Atlanta, Ga.—The Atlanta "Journal" says: "The officers of the General Electric Company in Atlanta are meeting with much encouragement in their efforts to aid Captain Eugene Griffin, of New York, in securing recruits for his brigade of engineers. Two well-known engineers of Atlanta, Edward Wilson and L. F. Bellinger, have applied for permission to raise companies, and if they succeed in raising 93 men each they will receive appointments as captains, provided the War Department approves. Twenty applications for enlistment have already been received, and also fifty additional letters seeking information about the brigade."

Chicago.—The movement set on foot by Capt. Eugene Griffin in regard to the organization of a corps of electrical engineers for service during the war was eagerly taken up in Chicago and a company of volunteer electrical engineers was at once formed. Prof. F. B. Badt, B. J. Arnold and E. P. Warner addressed a meeting of the Chicago Electrical Association in behalf of the movement and urged that the society offer its whole membership and strength to the Government in the way suggested.

Pittsburg.—The following extract from an item in the "Dispatch" shows that interest in the "electrical corps" movement is extending: "E. M. Sawtelle of Washington, D. C., formerly of this city, is in correspondence with a number of expert electricians of Pittsburg and vicinity with a view to securing 100 volunteers for a proposed electrical engineering corps for the United States Navy. The volunteer corps is the idea of Prof. Duncan of the School of Electrical Engineering of John Hopkins University. He is one of the most widely known authorities in the electrical world to-day. Prof. Duncan has communicated with the War Department relative to his plan, which is the enlistment and equipment of a volunteer force of 3,000 or more expert electricians, the company to serve the Government for two years as a part of the regular Naval Department. The proposition of Prof. Duncan, as far as known, has not yet been definitely accepted by the War Department. Sufficient encouragement, however, has been received to warrant a preliminary enrollment of electricians throughout the United States. Mr. Sawtelle offered his services to Prof. Duncan as far as the Pittsburg field was concerned and has been appointed recruiting officer for Pittsburg and vicinity. The quota of volunteers for this section is fixed at 100."

New York.—While engaged in the work of laying mine cables in the main channel at Sandy Hook on Saturday last, two electricians lost their lives through the upsetting of the boat in which they were at work by the French steamship La Touraine, outward bound. It is supposed that the screw of the steamer came into contact with the cable, a section of which was lying over the bow of the boat the cable men occupied. The men drowned were Victor Passa, an electrician, who lived in Brooklyn, and Robert Middleton, an employee of the General Electric Company, who resided at Orange, N. J. Six others who were in the boat were rescued.

PERSONAL AND MISCELLANEA.

R. Manchester has been granted a concession by the Omaha Exposition Commissioners for the operation at the Exposition of automatic models of a steam ship, locomotive, fire engine and electric light plant. The models, it is stated, are very handsome and cost \$4,000 each.

The native Philippine mothers are said to hush the crying of their children with the word "Castalia" (not Castoria), which means Spaniard. If a white man approaches a native dwelling of either the poor or the well-to-do the cry of "Castalia" is always heard as a warning from some one who may be on watch, and children are taught to flee at the word.

The X-ray apparatus devised by Prof. Reginald A. Fessenden of the Western University of Pennsylvania for the use of army surgeons in the field is no bigger than an unabridged dictionary and weighs twenty-five pounds. It is operated by a gas motor of equal weight.

The United States Patent Office has declared George D. Burton of Boston to be the original and sole inventor of the art and process of heating an electrically conductive body in a liquid, after a contention in the Patent Office, lasting six years, between Edward M. Bentley of New York, formerly of the Thomson-Houston Company, and Lagrange & Hoho, the alleged Belgian inventors. The Patent Office in making its decision states that Burton practised the art and process in 1883 and thereby is awarded priority over Bentley and Lagrange & Hoho, who first used the process in 1890.

The right to use the Edison patent electrical iron ore separator in the States of Minnesota, Wisconsin and Michigan is said to have been sold to a stock company now being organized for the purpose of utilizing it in the Lake Superior iron districts. Mr. Edison is himself, it is stated, heavily interested in the company, and this has directed his attention to the St. Louis river water power at Duluth and the large bodies of magnetic ore in Cook County and elsewhere in Minnesota which are not now merchantable.

Cleveland, O., has a 13-year-old boy who bids fair, says the Cleveland "Press," to astonish the world as an inventor and electrician. This singularly gifted boy's name is Jas. B. Kirby. He is the son of Jas. D. Kirby of Cleveland. Master Kirby is a born electrician. According to the "Press," "he presents the only known instance of a child born with a knowledge of electricity. But a little over a year ago, when the first principles were explained to him, the boy seemed to understand them intuitively. Among the long list of inventions for which Master Kirby is responsible is a telegraph instrument, galvanometer, magnets, induction coil, double carbon electric light and a microphone. It is claimed that the last named instrument will carry the voice 2,000 miles. Young Kirby has just completed a motor which is a complete success, and he is at present engaged upon a 16-cell battery. Young Kirby is known among his friends and associates as the wizard of the West Side."

The Columbus & Grove City Electric Railway will, according to the Columbus "Dispatch," be constructed under peculiar circumstances. "Generally railroads are built by contractors after a public letting, but the Grove City road is being built by the original promoter, Adam G. Grant. Mr. Grant is the 'whole thing.' He originated the idea of constructing a road. He pushed it to a point where the road could be built, and he is now himself building it. There will be no deals in the construction of this road. There will be no stockholders to look to for money. There will be no jobs in the contract. Mr. Grant uses his own money, in effect, to build a road for himself, and he will operate it. The question has been asked whether a company has been organized to hold a charter for this road, but it appears from investigation that there is no need of a company. The county commissioners granted the franchise to Mr. Grant himself; thus Mr. Grant holds the charter, builds the road and will operate it. Mr. Grant has not yet contracted for his cars, nor for the power necessary to operate his road. He expects to arrange these things before the road is constructed."

RECENT COMPANY ELECTIONS.

Camden, Gloucester & Woodbury Electric Railway Company, Gloucester, N. J.—President, J. Willard Morgan; treasurer, William J. Thompson; secretary, Thomas P. Curley; directors: William J. Thompson, Augustus Muller, Henry M. Harley, David Baird, J. Willard Morgan, Thomas P. Curley, John J. Curley, Thad. P. Varney and Henry J. West.

Citizens' Street Railway Company, Indianapolis, Ind.—Directors: W. W. Kurtz, B. H. Rushton, J. Levering Jones, Joseph S. Neff, B. M. Gaskill, W. C. Houston, William J. Turner, all of Philadelphia.

Kenton Gas & Electric Company, Kenton, O.—President, Thomas Espy; vice-president, Henry Price; secretary, W. S. Robinson; treasurer, H. C. Koller.

Missouri Railroad Company, St. Louis.—Directors: Charles D. McClure, Edwards Whitaker, Ephraim Catlin, J. C. Van Blarcom and Charles C. Maffitt. Mr. Whitaker will continue as president.

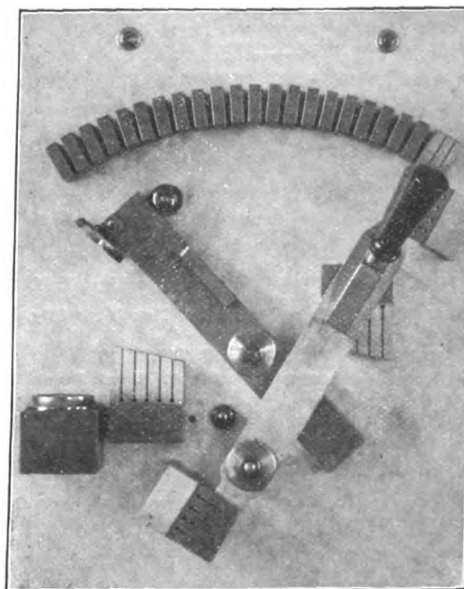
Nashville Street Railway Company, Nashville, Tenn.—Directors: A. H. Robinson, D. S. Williams, T. M. Steger, J. C. Bradford, N. Baxter, Jr., L. D. Tyson, S. M. Murphy.

Standard Electric Signal Company, Rochester, N. Y.—President, Howard A. Smith; vice-president, Stephen Remington; treasurer, George A. Benton; secretary and manager, Judson B. Loomis; directors: Howard A. Smith, Stephen Remington, W. Frank Carlton, Frank P. Crouch, Wilmot Castle, S. K. Newcomb, George A. Benton, Charles S. Curtice, M. B. Adams and Judson B. Loomis.

COMMERCIAL PARAGRAPHS.

We are indebted to the courtesy of Mr. Foree 'Bain' of Chicago for a neat little handbook of technical information which he has just published. This brochure, which may be conveniently carried in the breast pocket, contains on its first cover page a very useful blank form for personal records that may have to be referred to at any moment. The general contents cover a wide field and include valuable points for practical use; numbers in calculating weights, measures, etc.; dimensions, costs, strength, power, etc., of various articles, including electrical apparatus and materials; methods of solving many problems in practical work, and hundreds of points in regard to lighting, wiring, setting up machinery, etc., that are calculated to save much time and trouble. It also contains the diagrams recently devised by a committee of the Chicago Electrical Association to illustrate designs for electric apparatus in patent specifications, and a great deal of information about patents, domestic and foreign, and about other things that investors, electricians, machinists and others are often puzzled to obtain. A limited number of copies of this useful handbook have been printed for general circulation and will be sent postpaid upon receipt of five 2 cent postage stamps on application to Mr. Bain, 1657-59 Monadnock Block, Chicago.

We illustrate herewith a rheostat for starting a 300 H.P. motor on a 500 volt circuit. This rheostat is provided with a "no voltage" automatic release and was made by the



Ward Leonard Electric Company for the Walker Company, and is used in connection with the electric locomotive installation of the B. & O. Railway at Baltimore.

Attention is called to the advertisement of the De Vries Feed Water Heater and Purifier which will be found on the front cover of this number. This remarkable fuel saver was illustrated and described in an article which appeared in our last issue.

INCORPORATIONS.

The Victor Electric Company, Alexandria, Va. Capital stock, \$25,000.

The Electric Gas Regulator Company, San Francisco, Cal. Capital stock, \$30,000, with \$28,000 subscribed. Directors: C. T. Ryland, W. E. H. Williams, A. P. Seiler and S. C. Denson, San Francisco; W. C. Mahoney, Mill Valley, Cal.

The Hogan Electric Company, Charleston, W. Va. Capital stock limited to \$100,000. Incorporators: Alf. Brittenham, E. A. Botkin, A. G. Vickers, Charleston; John E. Laughlin, G. W. Arbogast, Clay Court House.

The McInnerney Manufacturing Company, Omaha, Neb.—to manufacture electric appliances, gas engines, etc. Capital stock, \$300,000. Incorporators: A. Millard, B. McInnerney, Philip Potter, C. G. Powell and Herbert M. Rogers.

The Des Plaines Valley Electric Railway Company, Chicago—to construct a railroad from some point in the township of Lyons to some point in Chicago. Capital stock, \$100,000. Incorporators and directors: Nelson F. Merrill, Hiram A. Johnson and H. Wallace Perce of Chicago, Henry B. Fargo of Geneva and Samuel S. Carman, Jr., of Oak Park.

The Chippewa Valley Electric Railroad Company, Eau Claire, Wis.—to build and operate the Interurban and Chippewa lines and eventually own and operate the whole system owned and operated by the present Chippewa Valley Electric Railway Company. Capital stock, \$300,000.

President, N. C. Wilcox; vice-president, H. N. Bates; secretary treasurer, A. E. Appleyard.

The Electric Street Railway Company, Bloomington, Ill. Capital stock, \$20,000. Incorporators: W. H. Beaver, J. W. Gray and J. Y. Chisholm.

The Rosseau's Electrical Works, New York City—to manufacture apparatus and appliances for electrical purposes. Capital stock, \$25,000. Directors: David Rosseau, of the borough of the Bronx; I. M. Randolph Molkleham, John Sheaffer Douglas, Charles H. Hart and Frederick W. Douglas of the borough of Manhattan, New York City.

Articles of consolidation and incorporation made and entered into March 21, 1898, between the Oakland Consolidated Street Railway Company, the Alameda, Oakland and Piedmont Electric Railway Company, and the Central Avenue Railway Company, have just been filed with the Secretary of State at Sacramento, Cal. They now become a part of the new Oakland Transit Company, the organization under which all of the Realty Syndicate railroads are being placed as rapidly as possible. The capital stock is \$5,000,000, divided into 100,000 shares of \$50 each. The directors are F. M. Smith, E. A. Heron, F. C. Havens, W. H. Martin, D. D. Harris, John C. Winans, C. R. Bishop.

The St. Louis *Republic* states that several "St. Louis parties, among the number being W. R. Dean, of the commission firm of Block, Dean & Co., are interested in an electric road, articles of incorporation for which have just been filed at Springfield, Ill. The capital stock is placed at \$1,500,000, and the proposed line is to run from Venice, Ill., on the east side of the Mississippi River to Durall, where a connection is to be made with the Chicago & Eastern Illinois Railroad. Freight and passengers will be carried. The incorporators are W. B. Dean of St. Louis, A. A. Barnes of Indianapolis, E. D. Waddle of East St. Louis and J. P. S. Gordon and G. A. Wilson of Collinsville. A spur will be built from the main line of the proposed road to Collinsville."

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 10, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 603,624. Electric Railway. Eben C. Crocker, Bridgeport, Conn., assignor of one-half to Edwin C. Howe, same place. Filed Sept. 17, 1897.
- 603,625. Electric Railway. Eben C. Crocker and Edwin C. Howe, Bridgeport, Conn. Filed Sept. 17, 1897.
- 603,656. Conduit for Railroads. Fred S. Pearson, Boston, Mass. Filed Sept. 14, 1897.
- 603,672. Trolley Device for Electric-Railway Cars. Louis E. Watkins, Springfield, Mass., assignor of one-half to Francke W. Dickinson, same place. Filed April 14, 1897.
- 603,728. Car-Fender. Elisa M. Johnson, Brooklyn, N. Y. Filed Sept. 9, 1897.
- 603,912. Car-Fender. Isaac Macowsky, New York City. Filed Sept. 21, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 603,630. Electric-Arc Lamp. Frederick A. Gilbert, Brookline, and Emil O. Lundin, Beaumont, Mass. Filed July 1, 1897.
- 603,687. Electric-Arc Lamp. John H. J. Haines, New York City, assignor to the Haines Electric Company, Jersey City, N. J. Filed May 27, 1897.
- 603,707. Electric Incandescent Lamp. William J. Phelps, Chicago, Ill. Filed Sept. 7, 1897.
- 603,876. Electric Headlight. Frederick W. Dressel, New York City. Filed Oct. 6, 1897.
- 603,882. Electric Lantern. Frederick G. W. J. Adams, London, England. Filed April 24, 1897.
- 603,883. Safety Incandescent Electric Lamp. Frederick G. W. J. Adams, London, England. Filed May 10, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 603,650. Automatic Electric Feed-Water Regulator. Andrew E. Maccoun and John Noey, Braddock, Pa. Filed Dec. 8, 1897.
- 603,693. Automatic Temperature-Regulating Apparatus. Walter B. Loring, Worcester, Mass. Filed Nov. 5, 1896.
- 603,709. Dynamo or Motor. Ferdinand Schwedtmann, St. Louis, Mo. Filed Oct. 23, 1897.
- 603,722. Electric Condenser. Charles S. Bradley, Avon, N. Y. Filed July 29, 1897.
- 603,778. Starting Device. Joseph P. Stone, Schenectady, N. Y., and Samuel E. Doane, Marlborough, Mass., assignors to the General Electric Company of New York. Filed Oct. 27, 1897.
- 603,786. Electrically-Controlled Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 23, 1897.
- 603,849. Switch for Electric Motors. Frank E. Herdman, Winetka, Ill. Filed Jan. 9, 1897.
- 603,875. Electrical Apparatus for Schools. Melvin E. Crowell, Indianapolis, Ind., assignor to the Crowell Apparatus Company, same place. Filed Nov. 23, 1896.
- 603,886. Electrical Steering Apparatus. Harry O. F. Bindemann, Madrid, Spain. Filed June 4, 1897.

ELECTRIC ELEVATORS.

- 603,665. Control Apparatus for Elevators. August Sundt, New York City, assignor to the Otis Brothers & Company, same place. Filed April 24, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 603,681. Throw-Off Switch for Telephones. Nathan Fajlek, San Francisco, Cal., assignor of thirty-one sixtieths to Frederick Hess, Jr., Albert K. Andriano and Isidore Harris, same place. Filed Aug. 17, 1897.

MISCELLANEOUS.

- 603,623. Conduit-Wiring Machine. William E. Cowan, Brooklyn, N. Y. Filed Aug. 27, 1897.
- 603,745. Underground Conduit for Electric Conductors. Charles H. Sewall, Chicago, Ill. Filed May 8, 1895.
- 603,815. Electrotherapeutic Apparatus. Gervaise G. Duke, Chicago, Ill. Filed Dec. 6, 1897.
- 603,890. Primary Element With Regenerable Negative Electrode. Oskar Rothmund Edler von Burgwall and Leopold Ofenschussl, Vienna, Austria-Hungary. Filed Dec. 9, 1896.
- 603,898. Alarm. Ira B. Frazee, Blairtown, Iowa. Filed March 6, 1897.
- 603,991. Cable-Stringer. Frank A. Cannon, Denver, Col. Filed Dec. 3, 1897.

TELEPHONE AND TELEGRAPH.

Telephone Extension in Minnesota.

The *Pioneer Press* of St. Paul, Minn., says St. Paul will soon have telephone connection with a multitude of towns and villages in Western, Central and Northern Wisconsin. "Two Wisconsin companies," it explains, "have combined to build a telephone line from Hudson to this city. These two companies connect with two other Wisconsin companies. The new line will be quickly completed. It must be of advantage to business men of the Twin Cities. The two companies building the line are the Pierce County Telephone Company and the Hudson Electric Exchange Company. The Pierce County line now has offices at Hudson, Rock Elm, Waverly, El Paso, Martell, Ellsworth, Beldenville, Trimble and Moeville. The Hudson Electric Exchange Company binds loquaciously together Hudson, New Richmond, Roberts, Hammond, Baldwin, Hersey, Woodville, Glenwood, Knapp and Menominee. Moreover, the Pierce County Company joins at Rock Elm the Union Telephone line, and thus extends to Maiden Rock, Lake City, Pepin, Ono and Plum City. The Hudson Exchange connects in turn, at New Richmond, with the Wisconsin Valley line, which communicates with all the principal business points in Northern Wisconsin."

A press dispatch from Montreal states that the placing of a new transcontinental telegraph wire between Montreal and Vancouver, B. C., has begun. The Canadian Pacific Railroad is stretching a new line from Montreal to Fort William, from Fort William to Donald, B. C., from Donald to Vancouver, where connection can be made with the new cable being laid from Vancouver to Victoria. In all the wire will be 2,900 miles long, weighing 800 pounds to the mile. Porcelain instead of glass insulators will be used, seventy-five tons of the former coming from Europe for the new line.

A special to the *Milwaukee Wisconsin* from New Richmond, Wis., states that the Bell Telephone Company is making desperate efforts to get into New Richmond, Hudson and River Falls, but it is doubtful if they will succeed. They have poles laid from Burkhardt, fourteen miles south, to the city limits of New Richmond, but cannot secure a franchise to go any further. A. T. Preason, manager of the St. Croix county telephone exchange, is to put in a local exchange in New Richmond this month.

Through the Bureau of American Republics it is learned that the Mexican Government has contracted with the Mexican Telegraph Company for the international service to be effected through the lines of that company and those of the Western Union of the United States. The Mexican Telegraph Company binds itself to pay the Government of Mexico 15 per cent. of the annual profits, guaranteeing that the 15 per cent. shall be not less than \$20,000 gold per annum.

The telephone examination by the House Committee at Washington, D. C., has brought out some interesting statistics. The entire number of telephones in use in Washington is 2,270, of which 443 are used by the Government, the 'phones costing the Government \$98 each. The deadhead 'phones number 59, the company using 84 of these.

The Missouri & Kansas telephone line between Fulton, Mo., and Jefferson City is nearly completed. The company is building a long distance line from St. Louis to Kansas City and will rebuild that part of the line between Kansas City and Sedalia, now in defective operation, so as to put it in first-class condition.

The quarterly report of the Western Union Telegraph Company filed a few days ago at Jackson, Miss., gives the capital stock of the company as \$100,000,000; taxes paid in Mississippi during the quarter, \$337 30; receipts within the State, \$31,143.28; expenses, \$26,937.77; net receipts, \$4,207.51.

Representatives of the New State Telephone Company have made arrangements at Metamora, Mich., for the construction of a line connecting Hadley, Metamora, Thornville, Dryden, Almont, Armada, Berville and Smith. It is to be in operation in less than a month.

A franchise has been granted to the Citizens' Telephone Company of New York by the board of trustees of the village of Lyons, N. Y. The telephone exchange is to be in operation within eight months. The company agrees to furnish the village with two telephones free of charge.

The Central and South American Telegraph Company announces that cable communication with Buenos Ayres and Uruguay via Galveston is not interrupted on account of the war, all the lines being operated as usual.

The Three Rivers (Mich.) Telephone Company, a local corporation, will declare a 20 per cent. dividend this year.

Wireless Telegraphy in England.

Experiments are being conducted on a system for telegraphing without wires between Lavernock Point near Barry Dock to Flat Holm Island in the British Channel, a distance of $8\frac{1}{2}$ miles. The Morse code of signals is used and the messages are read by sound. It is stated that 40 words per minute have been signaled across and read without difficulty. The system is the invention of W. H. Preece, engineer-in-chief of the English General Post Office. The idea of experimenting at this particular point was suggested by the difficulty of maintaining a cable free from accident for any considerable length of time. So many vessels drop anchor in these waters that the cable is frequently dragged about and broken. Mr. Preece's system employs a stout copper wire three-fourths of a mile in length, erected on poles on the mainland, with the ends of the wire running into the sea. On the island a similar wire about half a mile in length, with the ends grounded, runs parallel to that on the mainland. The transmission of the electric disturbances is due to electro-magnetic induction from waves set up in the conductor at the transmitting end. It is of course understood that the term "wireless" has reference to the absence of a metallic conductor connecting the points between which the signals are transmitted.

The Independent Telephone Company has completed its lines from Kalamazoo to Lansing, Mich. There is direct connection with Benton Harbor and as far south as Michigan City. Fort Wayne, Ind., will be reached in a few weeks, and Chicago is to be tapped by the new line.

Work on the telephone line from Sparta to McMinnville, Tenn., which is to be built by the Gainesboro Telephone Company begins this week. The line will connect Quebec with Doyle, Bone Cave, Goodbars and Increase.

At a meeting held in Brenham, Tex., on the 6th inst., a stock company was organized to establish a telephone line from Brenham to Shelby, Austin county, via Greenville and Saturn.

The U. S. Senate has passed a bill authorizing the enlistment of a Volunteer Signal Corps two-thirds of the members of which must be expert electricians or telegraphers.

Ordinances are now pending in the council at Akron, O., granting franchises to the Central Union Telephone Company and to the Citizens' Telephone & Telegraph Company.

The amended municipal license ordinance adopted by the common council of San Jose, Cal., requires each telephone company to pay \$100 per quarter.

An ordinance granting the new Lackawanna Telephone Company a franchise in Scranton, Pa., has passed its first reading in the select council.

New Companies Incorporated.

The Nicollet County Telephone & Telegraph Company, New Sweden, Minn.—to build a line from St. Peter to Sibley. Capital stock, \$3,000. Incorporators: C. O. Nelson, Joseph Peterson, A. L. Strauch, J. H. Housman, Martin P. Quist, Joseph A. Poetz, C. O. Gustafson, Henry A. Burke, August Olson.

The Northeast Telephone Company, Rush City, Minn. Capital stock, \$50,000. Incorporators: A. J. Stowe, C. F. Jacobson, J. D. Markham, of Rush City, and S. A. Nable, C. F. Nelson and N. J. Hoberg, of Danewood.

The Martin Telephone Company, Johnson City, Blanco county, Tex.—to construct and maintain a telephone line in Blanco, Hays, Travis, Burnet, Llano, Gillespie and adjoining counties. Capital stock, \$10,000. Incorporators: David Martin, J. W. Shugart and A. G. Peery.

The Albion Farmers' Telephone Company, Florenceville, Ia.—to operate a telephone line from Oresco to Florenceville, with branch lines connecting with the residences of stockholders. Capital, \$400.

The Mountain State Telephone & Telegraph Company, Charleston, W. Va. Capital stock limited to \$50,000. Incorporators: G. V. Forman, H. A. Forman, H. V. Thomas, of Buffalo, N. Y.; J. W. Penhale and C. B. Couch, of Charleston, W. Va.

The Camden Telephone Company, Camden, N. C. Incorporators: E. Mitchell, W. D. Kellam, P. G. Morrisette, H. T. Greenleaf and P. H. Williams.

The Bergen County Telephone Company—to operate a telephone system in numerous towns in Bergen county, N. J. Capital stock, \$50,000, business to begin with \$17,000. Incorporators: William A. Cullen and Charles L. Raller, of Newark, N. J.; Alfred B. Hopkins, of Montclair, N. J., and Dr. Eugene W. Davis, of New York.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: ert. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.	NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.
	Par	Authoriz'd	Issued.					Par	Authoriz'd	Issued.			
Albany, N. Y.—May 16:							Hartford Conn.—May 16:						
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1 1/2 % Q., Feb. '98.	140	142 1/2	Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000	8 % S., Jan., '98.	140	..
Troy City Railway Co.....	100	2,000,000	2,000,000	1 % Q., Dec. 10, '97.	68	70	Hartford & West Hartford RR.....	100	1,000,000	247,000	.....	..	..
Traction Co. (Saratoga).....	100	50,000	50,000	.....	..	..	Holyoke Mass.—May 16:						
Allentown, Pa.—May 16:							Holyoke Street Ry. Co.....						
Allentown & Lehigh Val. Trac. Co.....	..	4,000,000	1,500,000	.....	..	15	100	400,000	400,000	8 1/2 % A., Jan., '98.	200	206	
Bridgeport, Conn.—May 16:							Hoboken, N. J.—May 16:						
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000	8 %, 1892.	70	..
Baltimore, Md.—May 16:							Indianapolis, Ind.—May 16:						
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72	**Citizens' Passenger Ry.....	..	5,000,000	5,000,000	.....	24	26
aBaltimore Consolidated Ry. Co....	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	22 3/4	23	Lancaster, Pa.—May 16:						
Central Ry. Co. of Baltimore City..	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	..	..
Boston, Mass.—May 16:							Lancaster & Col. Electric Ry.....						
New England Street Ry.....	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..	West End Street Railway.....	..	..	87,500	.....	..	..
North Shore Traction Co.....com.	100	4,000,000	4,000,000	.....	10	13	Louisville, Ky.—May 16:						
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000	6 % S. A. & O.	67	72	Louisville Ry.....com.	100	4,000,000	8,500,000	1 1/2 %, Oct., '97.	80	85
b West End Street Ry. Co.....com.	50	10,000,000	9,085,000	4 % S. A., Oct., '97.	82	82 1/2	Louisville Ry.....	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	87	94
b West End Street Ry. Co.....8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	103	..	Minneapolis, Minn.—May 16:						
Boston Elevated R. R.....	100	10,000,000	6,400,000	4 % S., Oct. 1, '97.	60	61	Twin City Rapid Transit.....com.	100	17,000,000	15,010,000	.....	14	20
Brooklyn N. Y.—May 16:							Twin City Rapid Transit.....7 % pfd.						
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	185	195	..	8,000,000	1,714,200	1 3/4 % Jan., '98.	..	100	
Brooklyn Rap. Transit Co., tr. certf..	100	20,000,000	20,000,000	.....	89 1/2	40	Montreal, Canada.—May 16:						
aBrooklyn Heights Railroad.....	..	200,000	200,000	.....	..	..	Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8 % S., M. & N.	252	252 1/2
*aBrooklyn City RR.....guar.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	203	264	Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1 1/4 % S., J. & J.	96 1/2	96
aBrooklyn, Queens Co. & Sub. RR.....	..	2,000,000	2,000,000	.....	..	..	Memphis, Tenn.—May 16:						
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1 1/2 % Oct. 1, '97.	140	..	Memphis Street Railway Co.....	100	500,000	500,000	.....	15	..
Kings County Elevated.....	100	4,750,000	4,750,000	.....	..	..	New Haven, Conn.—May 16:						
Kings County Traction Co.....	100	4,500,000	4,500,000	1 1/2 % July 26, '97	..	47	Fair Haven & Westville RR.....	25	1,500,000	900,000	4 % S., Sept. '97.	60	..
Nassau Electric Railroad.....	..	6,000,000	6,000,000	.....	..	37 1/2	New Haven Street Railway Co.....	100	1,250,000	1,000,000	2 1/2 % A., July '98.	60	80
aAtlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	..	..	New Haven & Centerville.....	100	700,000	300,000	.....	..	..
aBrooklyn, B. & W. E. Railroad.....	..	1,000,000	1,000,000	.....	74	80	Winchester Avenue RR.....	25	1,000,000	600,000	.....	40	42
Buffalo, N. Y.—May 16:							New Orleans, La.—May 9:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	.....	58	60	Canal & Claiborne RR. Co.....	40	240,000	240,000	4 % S., Jan., '98.	140	160
*Buffalo Railway Co.....	100	6,000,000	5,370,500	1 % Q. Dec., '97.	78	80	New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	128 1/2	128
Columbus O.—May 16:							New Orleans Traction Co.....com.						
Columbus Street Railroad.....	100	8,000,000	8,000,000	1 % Q., Feb., '98.	45	48	New Orleans Traction Co.....pfd.	100	5,000,000	5,000,000	.....	1 1/2 %	8
Columbus Central Street Railroad..	100	1,500,000	1,500,000	.....	..	..	aCrescent City RR.....guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	30
Charleston, S. C.—May 16:							bNew Or. City & Lake RR.....guar.						
Charleston City Ry. Co.....	50	100,000	100,000	3 % S., Jan., '97.	..	..	Orleans Railroad.....	50	500,000	185,000	1 1/2 %, June, '94.	16	17
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	..	..	St. Charles Street Railway.....	50	1,000,000	1,000,000	1 1/2 % Jan., '98.	68 1/2	64 1/2
Chicago, Ill.—May 16:							New York—May 16:						
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3 % Q., Dec. 31, '97.	235	237	Central Croton RR.....	100	600,000	600,000	2 1/2 % Q., July, '97.	280	..
Chicago & South Side R. T. RR.....	100	10,823,800	10,823,800	.....	..	..	aChristopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	184	164
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	13	13 1/2	Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	175	195
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	.....	..	8 1/2	dMetropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1 1/2 % Q., Jan., '98.	180	180 1/2
Met. West Side El. const. stk.....	100	15,000,000	2,500,000	.....	..	..	eBleecker St. & Fulton Fy. Ry. guar.	100	900,000	900,000	2 % A., July, '97.	82	84
North Chicago Street RR.....	100	10,000,000	6,600,000	3 % Q., Jan., '98.	199	..	fBroadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	205	212
North Chicago City RR.....	100	500,000	249,900	.....	..	..	gCen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 1/4 % Q., Jan., '98.	170	170
South Chicago City Railway.....	100	2,000,000	1,603,200	.....	..	..	hElgin Avenue RR.....guar.	100	1,000,000	1,000,000	.....	800	826
West Chicago St. RR. Co.....	100	20,000,000	18,189,000	1 1/2 % Q., Feb. 98.	92	92 1/2	i42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 1/2 % Q., Feb., '98.	820	860
Chicago West Div. Ry.....guar.	100	1,250,000	624,900	35 % S.	..	..	jNinth Avenue RR.....guar.	100	800,000	800,000	.....	102	104
Chicago Passenger Ry.....guar.	100	2,000,000	2,000,000	5 % S.	..	..	kSixth Avenue RR.....guar.	100	2,000,000	2,000,000	.....	200	210
Cincinnati, Ohio.—May 16:							lTwenty-third St. R. R. Co. guar.						
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000	.....	..	20	Second Avenue RR.....	100	2,500,000	1,862,000	2 % Q., Jan., '98.	168	171
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000	2 1/2 % S., Feb., '98.	..	75	Third Avenue RR.....	100	12,000,000	10,000,000	2 % Q., Feb., '98.	165	167
Cincinnati, Newport & Gov. St. Ry.	100	4,000,000	8,500,000	.....	23	25	m42d St. Manhat'le & St. Nich. Av	100	2,500,000	2,500,000	.....	45	55
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	113	*Union (Huckberry) Ry.....	100	2,000,000	2,000,000	.....	175	200
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/4 % Q., Jan., '98.	..	..	Newark N. J.—May 16:						
Cleveland, Ohio.—May 16:							Consolidated Traction Co. of N. J....						
Akron, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000	3/4 % Jan., '98	39	40	Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	..	47
Cleveland City Ry.....	100	8,000,000	7,600,000	3/4 % Oct., '97.	55	60	aRapid Transit Street Ry.....	100	504,000	504,000	11 1/2 % A.	180	190
Cleveland Electric Ry.....	100	12,000,000	12,000,000	3/4 % Q., Oct., '97.	60	68	Pittsburg, Pa.—May 16:						
Detroit, Mich.—May 16:							Allegheny Traction Co.....						
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	.....	100%	..	aConsolidated Traction Co.....com.	50	500,000	500,000	.....	18 1/2 %	45
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000	5 % July, '96.	175	..	Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000	2 % S., Jan., '96.	45	46
Rapid Railway Co.....	100	250,000	250,000	.....	..	100	pCentral Traction Co.....	50	1,500,000	1,900,000	.....	..	..
Detroit Electric Railway.....	100	1,000,000	1,000,000	.....	..	..	qCitizens' Traction Co.....	50	8,000,000	13,000,000	6 % S. A.	..	..
Wyandotte & Detroit River Ry.....	100	250,000	200,000	.....	100	110	rDuquesne Traction Co.....	50	8,000,000	13,000,000	6 % S. A.	..	..
Dayton O.—May 16:							sPittsburg Traction Co.....						
City Railway Co.....com.	100	1,500,000	1,470,600	1 1/4 % Q., Jan. 1, '98.	100	102	Federal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000	3 1/2 % S., Jan., '98.	28 1/4	..
City Railway Co.....pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98.	140	145	Pgh., Allegheny & Man. Trac. Co....	50	8,000,000	12,994,839	2 % S., Aug., '96.	..	..
People's Street Railway.....	100	1,100,000	..	.....	100	..	Pittsburg & Birmingham Trac. Ry..	25	8,000,000	8,000,000	1 % S., Jan., '96.	18 1/2	189 1/2
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West End Ry.....						
							Pittsburg & West						

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Leased to New Orleans Traction Company at 6% on stock.
 c Leased to New Orleans Traction Company at 8% on stock.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavana Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 5% first 5 years, 8% thereafter;
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 6% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 7% on capital stock after October.
 t Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Croton Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavana Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 5% first 5 years, 8% thereafter;
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 6% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 7% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—May 16: Union Street Railway Co.....							Boston, Mass.—May 16: American Bell Telephone Co..... Erie Telegraph & Telephone Co..... New England Telephone Co.....						
Northampton, Mass.—May 16: Northampton Street Ry.....							New York.—May 16: American Telegraph & Cable Co.... *Central & South Am. Teleg. Co..... *Commercial Cable Co..... *Franklin Tel. Co..... *Erie Telegraph & Telephone Co..... *Gold & Stock Tel. Co. guar. 6 % *International Ocean Tel. Co. guar. 6 % Mexican Telephone Co..... *New York & New Jersey Tel. Co..... *Pacific & Atlantic Teleg. guar. 4 % *Postal Telegraph Cable Co..... *South'n & Atlantic Tel. Co. guar. 5 % *Commercial Union Telegraph Co..... Western Union Telegraph Co..... *Div. guar. by Postal Tel. Co.						
Omaha, Neb.—May 16: Omaha Street Ry.....							Miscellaneous.—May 16: American Dist. Teleg. (Phila.)..... Bell Teleph. Co. (of Canada)..... Chesapeake & Potomac Tele. Co..... Chicago Telephone Co..... Central Dist. Prtg. & Tel. Co. (Pgh.) Empire & Bay States Telegraph Co. Hudson River Telephone Co..... *Northwestern Telegraph Co. guar. Providence (R. I.) Teleph. Co..... Southern New Eng. Teleph. Co.....						
Paterson, N. J.—May 16: Paterson Ry. Co.....													
Providence, R. I.—May 16: United Traction & Electric Co.....													
Philadelphia.—May 16: Fairmount Park Trans. Co....\$20 pd. Hestonville, Man. & Fairmount..... Hest'nville, Man. & Fairm't. 6 % pfd. aFairmount Pk. & Had. Pass. Ry. aFairmount Co..... \$12 1/2 pd Electric Traction Co..... dCitizens' Passenger Ry..... dFrankford & Southwark Pass. R. dLehigh Avenue Ry. Co..... dLombard & South Street Ry..... dSecond & Third Streets Ry..... dPeople's Traction Co..... dGermantown Passenger Ry..... dGreen & Coates Passenger Ry. dPeople's Passenger Ry.....com. dPeople's Passenger Ry..... pfd. dPhiladelphia Traction Co..... dCatherine & Bainbridge St..... dContinental Pass. Ry..... guar. dEmpire Passenger Ry. Co..... dPhiladelphia City Pass. Ry..... dPhiladelphia & Gray's Ry. RR. dBridge Avenue Passenger Ry..... dPhiladelphia & Darby Ry. guar. d17th & 19th Sts. Pass. Ry. guar. dThirteenth & 15th Sts. Pass. Ry. dUnion Passenger Ry. Co..... dWest Philadelphia Pass. Ry.....							ELECTRIC LIGHT AND ELECTRICAL MFG. COS. Boston, Mass.—May 16: Fort Wayne Electric Co..... Ft. Wayne Elec. Co. T. Sec. Series A. General Electric Co.....com. General Electric Co..... pfd. T. H. Elec. Co. T. Secur., Series D. Westinghouse Elec. & Mfg. Co. com. Westinghouse El. & Mfg. Co. pfd. Westinghouse El. & Mfg. Co. assent. New York.—May 16: Edison Elec. Ill'g Co., New York.. *Edison Elec. Ill'g Co., Brooklyn.. Edison Ore Milling Co..... Edison Electric Storage Co..... General Electric Co.....com. General Electric Co..... pfd. Interior Conduit & Insulation Co.. United Elec. Lt. & Pow. Co..... pfd. Pittsburg, Pa.—May 16: Allegheny County Light Co..... East End Electric Light Co..... Philadelphia, Pa.—May 16: Edison Electric Light Co..... *Electric Storage Battery Co. com. *Electric Storage Battery Co. pfd. *Penna. Ht. Lt. & Pow. Co. com. *Penna. Ht. Lt. & Pow. Co. pfd. Northern Elec. Light & Power Co.. Southern Elec. Light & Power Co.. Miscellaneous.—May 16: Brush Electric Co..... Bridgeport (Conn.) Elec. Lt. Co.. Missouri-Edison (St. Louis)..... Eddy Electric Mfg. Co..... Hartford (Conn.) Elec. Light Co.. Hartford (Conn.) Lt. & Power Co.. New Haven (Conn.) Elec. Lt. Co.. Narragansett (Prov., R.I.) Elec. Co.. Rhode Island Elec. Protec. Co..... Royal Elec. Co. (Montreal)..... Toronto (Canada) Elec. Light Co.. Thomson-Houston Welding Co..... Woonsocket (R. I.) Electric Co.....						
Rochester, N. Y.—May 16: Rochester Railway Co.....													
Reading, Pa.—May 16: Reading Traction Co..... dCity Passenger Ry..... dEast Reading Electric Ry.....													
St. Louis Mo.—May 16: Fourth Street & Arsenal Ry..... Jefferson Avenue Ry. Co..... Lindell Ry..... National Railway Co..... Cass Avenue & Fair Grounds..... Citizens' RR..... St. Louis RR..... Missouri RR..... People's RR. Co..... Southern Electric Ry.....com. Southern Electric Ry..... 6 % pref. St. Louis & Suburban Ry..... Union Depot RR.....													
San Francisco, Cal.—May: California St. Cable RR..... Geary Street Park & Ocean RR..... Market Street Ry..... Presidio & Ferries RR.....													
Scranton, Pa.—May 16: Scranton Railway Co..... mScranton & Carbondale Trac. Co.. mScranton & Pittston Traction Co.													
Springfield Ill.—May 16: Springfield Consolidated Ry.....													
Springfield O.—May 16: Springfield Street Ry.....													
Springfield, Mass.—May 16: Springfield Street Ry.....													
Toronto Canada.—May 16: Toronto Ry. Co..... Montreal Street Railway Co.....													
Washington, D. C.—May 16: Belt Ry. Co..... Capital Traction Co..... Columbia Ry. Co..... Eckington & Soldiers' Home Ry..... Georgetown & Tenallytown Ry..... Metropolitan RR. Co.....													
Worcester, Mass.—May 16: *Worcester Traction Co.....com. *Worcester Traction Co..... 6 % pfd. Worcester & Suburban Street Ry...													
Wilkesbarre, Pa.—May 16: Wilkesbarre & Wyoming Val. Trac.													

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
Albany, N. Y.						
Date of Quotation—May 16, 1898						
The Albany Ry.....1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....
The Albany Ry. Co.....Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....
The Albany Ry. Co.....Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....
Watervleit Turnpike & RR.1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117½	.....
Watervleit Turnpike & RR.2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115½	.....
Troy City Railway Co.....1st 5s	.....	.....	.....	.....	*105½	105¾
Interest guar. by Albany Ry. Co.						
Principal and interest guar. by Albany Ry. Co.						

Baltimore Md.						
Date of Quotation—May 16, 1898						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Exten. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	102½	103
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114½	115
Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101½	.....
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103½	.....
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	113	116
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113¾	114¼
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119½
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. †\$151,000 in escrow to retire 1st mtg. bds.						

Boston, Mass.						
Date of Quotation—May 16, 1898.						
Lynn & Boston RR. 1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	161½	105
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	.....
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
†\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						

Charleston S. C.						
Date of Quotation—May 16, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....
†Controlled by Charleston St. Ry. Co.						

Chicago Ill.						
Date of Quotation—May 16, 1898.						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	1017½	102½
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103¾	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	104½	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	69	70
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	104	106
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	103
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	.....
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	105	.....
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	103	104
West Chicago St. RR. 1st mtg. 5s.	4,100,000	2,700,000	1928	M. & N.	100	100¼
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	90½	91¼
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	102	.....
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....
†Redeemable at option on 60 da. notice. †Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. †Subject to call after Oct. 1, 1899, at \$110 and interest. †Assumed by W. Chi. RR. Co., lessee. †Int. guar. by W. Chicago St. RR. Co.						

Cincinnati, O.						
Date of Quotation—May 16, 1898.						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	111	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	.....	108½
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	.....	119
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	.....	129½
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	.....	.....
†Assumed by the Cin. St. Ry. Co. †\$250,000 reserved to retire 1st mtg. bds.						

Cleveland, O.						
Date of Quotation—May 16, 1898.						
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. Newt & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	103
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	101½	105
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & N.	.....	.....
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 5s.	600,000	.....	1922	J. & J.	.....	.....
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	.....	.....
†\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. †Interest guar. by Cons. St. Ry. Co.						

Detroit, Mich.						
Date of Quotation—May 16, 1898.						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	96¼	99
Ft. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	.....
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
†\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						

New Haven Conn.						
Date of Quotation—May 16, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	103	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	.....
Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	102	.....

New Orleans La.						
Date of Quotation—May 10, 1898.						
Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75½	77
New Orleans City RR. 1st mtg. 6s.	416,500	899,000	1903	J. & D.	108	111
N. Or. City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98¾	99¾
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	110	.....
Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	93¾	100
St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....
†\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. †\$90,000 outstanding.						

New York.						
Date of Quotation—May 16, 1898.						
Atlantic Ave. (Brooklyn).... Imp. g. 5s.	1,500,000	1,500,000	1984	J. & J.	85	87
Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	.....
Atlantic Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	105	109
Broadway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	116	119
Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	107
Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	115	117
Broadway Surface 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	106	107
Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	113	116
Brooklyn Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	84	87
Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	95	.....
Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108
Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	94	95
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	103	107
Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	113
Central Cross-town RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	108	105
D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	114	117½
Dry Dock, E. Bd'y & Bat'y R. scrip 5%	1,100,000	1,100,000	1914	F. & A.	100	108
Elighth Av. RR. Co. Cert. Indeb. 6%	1,000,000	1,000,000	1914	F. & A.	108	.....
42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	116
42d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	83	90
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	114½	116
Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,500,000	17,500,000	1997	F. & A.	112½	.....
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	111
Second Avenue Ry. Deb. 5s.	800,000	800,000	1909	J. & J.	108	.....
Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	106	111
Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	118½	120
Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108
Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111½	114
Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....
\$1,035,000 in escrow to retire gen. mtg. bonds.						
\$4,850,000 in escrow to retire maturing obligations.						
\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
In treasury, \$80,000.						
Guar. by Union Ry. Co.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—May 16, 1898.						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	105	107
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric.....1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	101
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	109½	110½
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	112½	113½
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$200,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—May, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Gary St., Park & Ocean RR.....1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	.....
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry. Co.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—May 16, 1898.						
Belt Ry. Co.....1st mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	118	.....
Eckington & Soldiers' Home.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—May 16, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
Croftown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	18,965,000	1933	J. & D.	102½	108
Croftown St. Ry. (Colu's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co.....Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	500,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	.....
St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$900,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						
*With interest						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—May 16, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	108	.....
Pittsburg, Pa.						
Date of Quotation—May 16, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	.....	J. & J.	105	.....
Allegheny City Electric Light..... 4s.	260,000	.....	.....	1918	A. & O.	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	.....	M. & S.	.....
Miscellaneous. —(May 16, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,812,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,116,000	1993	.....	114½	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia)...	2,000,000	.....	.....	.....	108	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—May 16, 1898.						
American Bell Telephone..... 7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telegraph Co..... 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co..... 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—May 16, 1898.						
American Electric Heating..... 5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co.....	.....	.....	.....	.....	.....	25
Barney & Smith Car Co..... 10s	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co..... 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co.....	75,000	.....	.....	.....	.....	.....
*Unlisted †Nominal						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 12c.; casting, 11½c.

The Third Avenue Railroad Company, New York, has declared a quarterly dividend of \$2 a share, payable May 31.

The Cincinnati & Hamilton Electric Street Railway Company has increased its capital stock from \$350,000 to \$600,000.

A leading commission house advises its customers: "The effect of war was discounted in advance of a declaration of war. Take care that you do not discount the declaration of peace."

The gross earnings of the Edison Electric Illuminating Company of Brooklyn for the month of April were \$73,590; net, \$28,713. For the same month in 1897 the gross earnings were \$67,985; net, \$28,568.

The Philadelphia "Stockholder" says it is asserted by a competent authority that the July semi-annual dividend on Baltimore Consolidated Railway will be not less than 2 per cent.

A member of the executive committee of the Western Union Telegraph Company says that the earnings have run considerably ahead of expectations, the gains being attributed to the war excitement and the demand for the rapid transmission of news.

The reorganization committee of the Brooklyn Elevated Railroad Company give notice that the fourth and last installment of 35 per cent. of the amounts to be paid by the security holders is payable at the Central Trust Company of New York on or before June 1.

The Boston "News Bureau" says that people familiar with the situation of the Boston Electric Light Company figure that with the new and improved works at South Boston the company will have improved its position by at least \$1,000,000. At present the company is earning more than 10 per cent. per annum.

The Van Choate Electric Company has commenced two suits for damages against the town of Foxboro, Mass., and attached all the town property. One suit is for \$100,000 damages for failure by the town to carry out and fulfil its agreements with the company in regard to locating its works in the town.

President C. L. Rossiter of the Brooklyn Heights Railway Company has addressed a letter to Bridge Commissioner Shea in which he fully discusses the question of the proposed increase in the tolls for cars of the street railway companies using the Brooklyn Bridge. He intimates that the increase suggested by the Commissioner would not be accepted by the car companies.

Mr. John C. Russell, chairman of the Louisville stockholders' committee of the New Orleans Traction Company on his return from Louisville to New Orleans last week stated that he had been conferring with the New Orleans holders of the stock of the company and found that there was no desire on the part of the New Orleans holders to freeze out the Louisville holders; they are ready to listen to any reasonable plan of reorganization.

The lease of the Consolidated Traction Company of New Jersey by the North Jersey Railroad Company goes into effect on the 25th inst. Among those who will control the lease are Vice-President Hobart, United States Senator Sewell, John D. Crimmins of New York City, E. F. C. Young of Jersey City, Bernard F. Shanley of Newark, N. J., and Stephen B. Elkins and P. A. B. Widener of Philadelphia.

Receiver Uhlmann of the Brooklyn "L" is quoted as saying that unless some unforeseen accident occurred the "L" trains of his company would be crossing the bridge by June 15 next. "Our first shipment of the motor cars from Pullman, Ill., will arrive here in a few days," said Mr. Uhlmann. "The work on the Manhattan end of the bridge is completed and the connections with the bridge at Washington street from Adams is being pushed as rapidly as the men can work. Nearly all our cars are equipped with side doors, and as we have the grips ready we can adjust them very readily. I have every reason to believe we will be crossing the bridge by June 15 sure."

In the suit of the people through Attorney General Hancock to dissolve the Kings County Traction Company, Brooklyn, N. Y., James C. Church procured from Justice Van Wyck, on the 12th inst., an order requiring the defendant to show cause why a receiver should not be appointed. The ground of the application, according to the papers, is a belief that the trustees, under pressure by E. Harriman, at the head of a syndicate proposing the reconstruction of the company, may consent to a call of a loan and the selling out of the property.

A Boston financial paper publishes the following as a special from New York: "The next move to be made in the reduction of the capital stock of the General Electric Company will be a call for a special stockholders' meeting. Just when this meeting will be called is not yet decided. This matter does not legitimately come under the control of the directors for action which must necessarily emanate from the stockholders. Those who held proxies at the recent annual meeting did not feel that it would have been right to take decisive action in this direction unless the proxies had given direct assent for the purpose. The special stockholders' meeting will probably appoint a committee to confer with the preferred stockholders, after which the whole matter is to come before another stockholders' meeting for settlement."

The Brooklyn "Standard Union" says: "The absorption by the Edison Electric Illuminating Company of Brooklyn of the Municipal Electric Light Company will be practically effected at a special meeting of the former company at its offices, 360 Pearl street, at 11 o'clock, Thursday morning, June 2, to act upon a proposition to increase the capital from \$4,000,000 to \$5,000,000. President Doty, in an explanatory letter to the stockholders, says that an issue of consolidated bonds is proposed to carry out the agreement to acquire certain shares of the stock of the Municipal Company, and that the officers of the Edison believe that its acquisition will prove as advantageous as that of the Citizens' a few years since. The Municipal stock receives in the 'deal' \$200 in cash or in Edison 5 per cent. consolidated bonds, the amount necessary to carry out the transaction exceeding \$2,000,000."

Time and again it has been conclusively shown that State control of railroads and municipal ownership of street railway transportation companies proves less satisfactory than when they are managed by private capitalists. This has not only been made patent in this country but abroad as well. A recent report on "Municipal Ownership of Street Railways" refers to the subject in this wise: "The experiment of State ownership of railroads has been tried longer in France than in Brazil and under more favorable conditions. The model road there runs through well-populated districts with large cities as terminals, but the results in France are discouraging. Eighteen years ago a railroad system was constructed which was to furnish cheap rates for passengers, cheap freight for shippers and abundant profits for the State. It has done none of these things. At first the advocates of the enterprise insisted that only time was required to prove the wisdom of the project. Eighteen years have passed and the results may be briefly summarized. Theoretic methods have been abandoned, and the railroad is now managed substantially as are those in the hands of private capitalists, except that its tariff of rates is a little higher and its cost of operation is considerably larger. The last report shows that the net return on the whole capital is 1.35 per cent. The Government has every year a considerable deficiency to settle, and the people who use the line pay somewhat more than they would have done if the enterprise had been left to private capital."

ELECTRICITY.

Vol. XIV.

NEW YORK, MAY 23, 1898.

No. 20.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	305-308
A War of Science.	
The National Electric Light Convention.	
A Would-Be Blow at Trusts.	
The War Revenue Bill.	
Under the Searchlight,	306
National Electric Light Association,	306
The Electrical Exhibition,	307
A Magnetic Balance for Workshop Tests of Permeability. By Prof. J. A. Ewing, F. R. S.,	309
The Distribution of Electrical Energy in Paris. By J. Laffargue,	310
The Electro-Chemical and Electro-Metallurgical Industries of Europe. Chap. XX—The Electrolytic Tin Industry. By J. B. C. Kershaw, F. I. C.,	311
A Triumph of Science,	312
A Special Prize Offer,	312
Legal Notes,	313
Society News,	313
American Institute of Electrical Engineers.	
The New York Electrical Society.	
The Trans-Mississippi Exposition,	313
Canadian Notes,	313
The News,	313
Street Railways—Lighting Plants—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Recent Company Elections,	315
Commercial Paragraphs,	315
Incorporations,	316
Electrical Patent Record,	316
Telephone and Telegraph,	316
Electrical Securities—Stocks, Bonds, Etc.,	317
Notes for Investors,	320

EDITORIAL NOTES.

As was predicted some time ago, our present struggle with Spain is to a large extent one of mathematics and electricity. The only war that has ever been previously fought upon scientific principles, and in which modern electrical appliances were extensively employed, was that between Japan and China, and that contest can hardly be looked upon as a criterion in view of the little resistance the Japanese met with. It is no exaggeration to say that at the present day the result of a naval battle between two modern fleets might hinge on the rupture of an electrical conductor or on the burning out of an armature. As Lieutenant Bradley A. Fiske said a number of years ago, in an address before the New York Electrical Society, "Electricity is not used in warfare as a convenience, nor is it a fad of theorists—it hoists the ammunition to the deck; it trains and fires the guns; it gives, by means of the range and position finder, the distance and position of the enemy's ships; it gives a means of signaling; it actuates the torpedoes; it lights and ventilates the ship; in fact, it does good, honest, practical work."

It will readily be seen that were any of the electrical apparatus employed in operating these various pieces of machinery to get out of order, a ship in a naval combat would be at a terrible disadvantage.

Probably nowhere in war is electricity of more importance than in the firing of submarine mines. During the past month hundreds of these mines have been planted in the various harbors along the Atlantic coast. Some of the mines thus far laid are what are known as contact mines and are moored a few feet below the surface of the water. These are in circuit with an electric battery located on shore, and are arranged to explode on being struck by a passing ship, which drives in a pin, thus completing the circuit. The greater number of the submarine mines, however, are what are termed buoyant mines. These are anchored to the bottom like the others but can only be exploded from the shore by closing a switch. At Fort Hamilton, for instance, the mine wires all terminate in a bomb proof chamber in which the operator is located.

Considerable trouble has been experienced in keeping intact the electrical connections owing to the carelessness of friendly vessels breaking the connections in passing in and out. A narrow channel has, however, been lately marked out which outgoing and incoming vessels are obliged to take or run the risk of being fired upon by Government patrol boats. It is absolutely essential that ships should keep to this channel, as the continual breaking of the electrical mine connections is not only a

serious but likewise costly matter. Trained electricians are required to keep these mine connections in working order, and it is therefore essential that the Government should have in its employ a large number of trained engineers. At the present time the steps that are being taken toward the formation of several electrical Government corps are to be commended. As Lieut. Fiske correctly prophesied several years ago, the immediate employment of such corps will be in the torpedo defence of the harbors, and the services of men accustomed to difficult electrical work and familiar with the latest methods will be of incalculable value.

The firing of miniature submarine mines at the Electrical Exhibition by the Marconi method has brought up the question as to whether it would not be possible to fire a harbor mine by means of Hertzian waves in the same manner and thus do away with the present complicated system of wiring. In the opinion of Mr. Clark, the well-known electrical expert in wireless telegraphy, this could be accomplished in spite of the fact that a large body of salt water, being a good conductor, might act as a shield to the coherer and obstruct the passage of the electric waves in the same manner that a mass of metal would. To overcome this difficulty Mr. Clark suggests running a wire from the receiving apparatus to the surface of the water and thus furnish a path of little resistance to the coherer. To prevent all the mines in a harbor from being discharged simultaneously by the electric waves it would be necessary to have a large number of transmitters, each differently tuned or in step with its special coherer at a certain mine. For this reason it may be some time before the wireless apparatus is adopted for this use.

* * *

The National Electric Light Convention.

The annual meeting of the National Electric Light Association, the most important event in the year in electrical circles, will take place in Chicago on June 7, 8 and 9. The headquarters of the Association will be at the Auditorium Hotel. Preparations are now being made on an elaborate scale for the reception and entertainment of the members, and it is safe to predict that the coming meeting will be one of the most successful yet held both from an intellectual and social standpoint. A number of excellent papers on distribution and lighting are to be read and fully discussed, which should materially add to the existing information on these subjects.

A committee of twenty-five has been appointed to act as a reception committee, composed of representatives of leading electrical interests in Chicago. These gentlemen will receive and entertain the visiting members and unquestionably afford them a good

time, without however interfering with the work of the Convention.

President Insull, on behalf of the Chicago Edison Company, has extended a general invitation to manufacturers and agents having apparatus and supplies of any kind in use in the Edison system to invite friends to inspect these products in actual operation. The Western Electric Company also propose to issue a circular inviting members of the Association and other visitors to inspect their factory during the Convention week. As the delegates from the vicinity of New York are expected to arrive in Chicago on Monday, the 6th, it is proposed to hold an informal reception at the Association's headquarters in the Auditorium on Monday evening, with a view to having the visiting members meet the local central station men and representatives of allied industries. As a large number of ladies are expected to be present, no pains are being spared to make their visit enjoyable. For their special benefit there will be several trips in trolley-coaches about the beautiful parks and boulevards in Chicago while the Convention is in session. Altogether the next Convention should be one of the best attended, most instructive and enjoyable yet held.

* * *

A Would-be Blow at Trusts.

It is surprising how strong public sentiment is getting to be against trusts and combinations. As an example, there is a bill now before the House of Representatives in Washington which seeks to provide among other things that it shall be unlawful for the director of any railroad, telegraph, express, steamship or telephone company, national bank, or any member or officer of any combination or association formed for the purpose of controlling the price of any article of commerce, in other words, a member of any trust, to either hold the office of President of the United States, be a member of the Cabinet, a Senator, Representative in Congress, Judge of any United States Court, or to be the head of any Department or Bureau of the Government. The holding of any of the positions mentioned above would render their election or appointment to any of these named offices null and void. Every officer would be required upon entering on the duties of his office to take an oath, in addition to the usual oath of office, in which he would state whether or not he was a director of any of the organizations mentioned above, and if so he could not qualify. The measure would also operate retroactively in so far as that the present occupants of these positions would be required to answer under oath with reference to these proposed limitations, and if they could not qualify their positions would be declared vacant.

Although it is scarcely likely that this bill will become a law at the present time, it is an indication of the sentiment that is getting to prevail throughout this country. As it is impossible to prevent a man from joining a trust, it is evidently the intention of the father of this bill to strike at the members, or would-be members, of a trust through their political aspirations. This bill is but the first rumbling of a storm which may burst with all its fury later.

* * *

The War Revenue Bill.

A correspondent advises us that the Revenue Tax Bill H. R. 10,100, now in the Senate, calls for the placing of a 4-cent stamp on all proprietary articles sold for \$1. This, if we mistake not, is the same tax that was put in force in 1861 and 1862, and means that manufacturers of proprietary articles will be called upon to pay from 8 to 10 per cent. of their gross business. Our correspondent suggests that this tax, amounting to a reduction of from 8 to 10 per cent. of the gross business of many manufacturers, will not only seriously affect the manufacturers, but also the advertising business throughout the country. There is scarcely any busi-

ness that can stand such a tax, and it would result in a loss of at least \$5,000,000 a year to the newspapers of America, and in addition to this, undoubtedly many advertisers will be forced out of business. The proposed bill, as previously stated, imposes a tax of 4 cents on each \$1 worth of goods, and this means from 8 to 10 cents on wholesale prices. This certainly seems to us too great a burden for any class of producers.

It would seem as though this proposed tax could well be reduced to say 1 cent on the dollar, which would not then be so hard upon the proprietary manufacturers and would still net the Government a good return. As we understand it, the proprietary men of America are willing to pay a reasonable tax, but claim that the tax proposed is unjust for the reason that it does not take in thousands of articles sold under arbitrary trade names and trade marks and under patent protection.

Under the Searchlight.

Notes and Comments on Various Topics.

THE *Advertiser* of Boston, Mass., says:

New York, judging from the number of tips sent over to buy, evidently wants Boston to buy some of its General Electric. The talk is for 40 to 45 on this rally. After some inquiry the source of this 45 price was found. It seems that a plan of readjusting the capitalization of the company, which is finding many advocates, is to pay the 31½ per cent. back dividends on the preferred stock in cash if the preferred stockholders will agree to take common shares for their preferred on the basis of 45, the common meantime to be cut one-half. On the aggregate capital of \$17,000,000 or thereabouts, it is likely the company could earn from 6 to 10 per cent., and though it might strike a preferred stockholder as a little rough at first, still it is a plan that would bear looking at, for the preferred has merely a preference in dividends, not assets, and in agreeing to a cut of half in their stock the common stockholders are themselves making sacrifices.

There is not the slightest doubt but what the preferred stockholders, like the owner of the proverbial elephant who ruined its owner by his enormous appetite, are willing to make almost any sacrifice to get even a small dividend on the stock they have been holding as so much waste paper for years.

* * *

THE Memorial Day souvenir just issued by the American Electrical Works, Providence, R. I., is an exceedingly life-like engraving of President Lincoln with a fac-simile autograph, accompanied by a handsome card on which is printed in full the famous address of Mr. Lincoln delivered at the dedication of the Gettysburg cemetery. The souvenir is a graceful reminder of the day and adds another to the happily conceived commemorative presentations of the American Electrical Works.

* * *

CONSCIOUS of a lack of descriptive talent in its editorial staff, the *Electrical Review* last week induced a 12-year old school girl to visit the Electrical Exhibition for the purpose of getting her impressions of the show as a basis for a write-up of the various exhibits. The little miss saw a great many things she didn't understand, but this did not affect her availability as a contributor to the paper—she understood enough to speak in ecstatic terms of a little sign stuck up over one of the booths on which was lettered "Electrical Review," and most of her time and attention was apparently given to a study of this strange device. It fairly dazzled her—she seemed rooted to the spot on which she stood when it burst upon her vision, and she remained there for ever so long revelling in the joy she felt in beholding the words—"Electrical Review." The rest of the show ceased to interest her as soon as she clapped eyes on the letters. That was all-sufficient—it was like a delicious dream. The E-l-e-c-t-r-i-c-a-l R-e-v-i-e-w! What was that central canopy with its graceful columns clothed in soft effulgence from a myriad lights—what was the electric cascade and

fountain—the Marconi telegraphy—the Moore chapel—the blown-up cruisers—the great dynamos at work and at rest—the motors, transformers, converters—the heating and cooking apparatus—the railway car and conduit—the switchboards and circuit breakers—the beautiful measuring instruments—the brilliant arc and incandescent lamps and lighting appliances—the phono, kineto and other graphs—the unique galvanoplastic exhibits—the tableaux and medals and pictures, and the thousand and one other attractions of the great show! What were they all?—simply hazy settings of the gem that held this simple little school girl absorbed, transfixed, surcharged with overpowering emotion, the sign of this jaundiced-colored little hebdomadal, the *Electrical Review*! That at least is the inference that would spring to one's mind at once on reading the report of this school girl's observations in the last number of the *Review*, which by the way, for a wonder, had a part of a single column that was worth reading, and that was the contribution of the little school girl. It was a great coup.

* * *

The United States *Investor* of May 21 in one of its items hazards the opinion that the Westinghouse Company "would merit the confidence of the public if it would furnish for the benefit of its stockholders statements of earnings." The company evidently takes a different view.

* * *

SAN FRANCISCO harbor has recently been provided with an exceedingly powerful searchlight.

* * *

A CABLE despatch to the New York *Sun*, dated London, May 21, says:

The first reports of the use of the Roentgen rays in warfare was made yesterday at the United Service Institution by Surgeon Beevor, who described the results of their use in the recent frontier campaign in India and gave lantern views. Many important cases consisted of bullet wounds received by officers and men who were injured in the bones, joints and internal organs. Their injuries but for the X-rays would have resulted in the amputation of limbs and probable loss of life. The pictures shown included wounds in the arm, leg, chest, back, finger and other parts. The most remarkable results, perhaps, were a case of a bullet embedded in the backbone, another in the hip, and the case of an Indian soldier who was shot in the foot, pieces of the bullet finally lodging in the back of the heel; also the case of Gen. Woodhouse, who received bullet wounds in the leg and arm at Dargai. In all the instances enumerated the bullets were by the use of the X-rays successfully removed, the men subsequently rejoining their comrades at the front. The portable apparatus weighs 80 to 100 pounds.

National Electric Light Association.

The following is a list of papers to be read, topics of discussion, and lecture at the Convention of the N. E. L. Association to be held at Chicago, June 7, 8 and 9:

PAPERS.

- "Cost of Generation and Distribution of a Unit of Electricity." By Calvin W. Rice.
- "General Distribution from Central Stations by Alternating Currents." By Herbert A. Wagner.
- "General Distribution from Central Stations by Direct Currents." By Louis A. Ferguson.
- "Public Lighting with Relation to Public Ownership or Control." By Alex. Dow.
- "Transformer Economy." By Winder Elwell Goldsborough.

TOPICS FOR DISCUSSION.

- "Legislative Policy as to Public Service Corporations."
- "Prices and Discounts for Electric Current, and Methods of Charging Customers."
- "Standardizing Apparatus for Central Station Use."
- "Standardizing Specifications for Incandescent Lamps."
- "Freight Rates on Electrical Apparatus."

LECTURE.

- "Electricity Direct from Coal." By Joseph Wetzler.

THE ELECTRICAL EXHIBITION.

Interest in the Show Increasing—Crowds of Spectators at All the Machinery Booths—The Submarine Mine Explosions Please the Children—Company Exhibits.

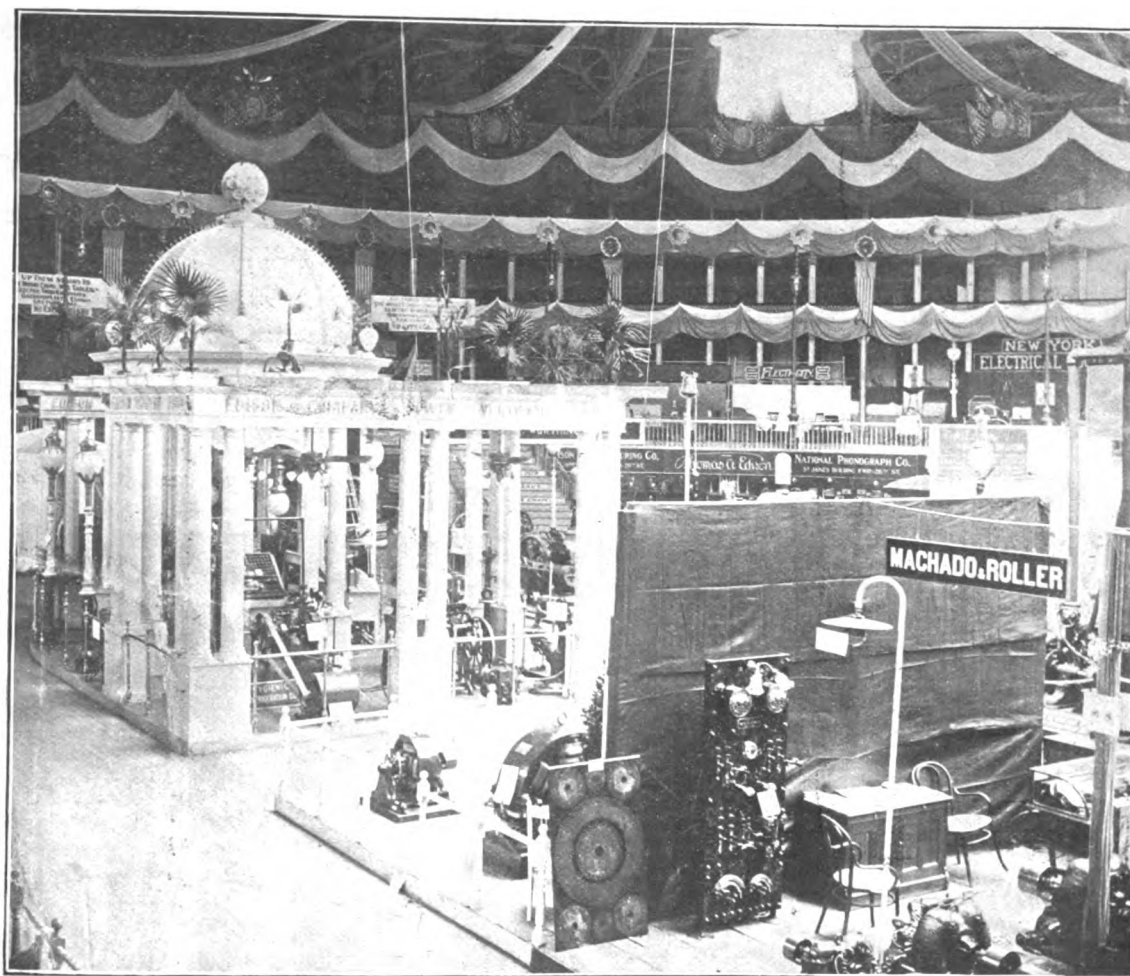
The last week of the Electrical Exhibition is at hand, and before the next issue of *ELECTRICITY* has been distributed to its readers this wonderful show will have passed into history, not however to be forgotten, but remembered as marking an important point in the progress of electrical development.

During the past week interest in the Exhibition seems, if anything, to have grown, as the attendance has been exceedingly large. Among others, hundreds of school children have visited the show in classes, accompanied by teachers, which demonstrates how highly the Exhibition is generally thought of as an educational medium. Of the many features of interest, the submarine mine explosions seem to attract these little ones the most, and the unceasing

COMPANY EXHIBITS.

The Fostoria Incandescent Lamp Company and the Crouse-Tremaine Carbon Company of Fostoria, Ohio, occupy together a double section which forms one of the most attractive exhibits of the Electrical Show. Along the front of the booth there are six white columns, three on either side of the central entrance, surmounted by globes with vari colored Fostoria lamps. The graceful columns themselves are entwined with spiral tendrils lighted by tiny miniature lamps of different colors. When the thousand lamps which go to make up this display are lighted, the booth and vicinity is most brilliantly illuminated. On a large sample board at the back of the booth is shown Fostoria lamps of all voltages and styles, including etched, frosted and corrugated bulbs. The patent lamp "Duplex" is also shown. This lamp has two standard 16 CP. filaments so connected that by turning a switch on the lamp base one of the filaments may be cut out of circuit, thus reducing the intensity of light from 32 to 16 candle

The Sprague Electric Company, as will be seen by the accompanying illustration, has probably the most elaborate exhibit at the show. This exhibit is located at the east end of the Garden, the total floor space of the company being 65 x 12 feet. An electric sign, some fifty feet in length, is constantly displayed. Among numerous other things this company is exhibiting a direct-connected lighting plant with a Case engine, six pole generator of 25 horse-power; special Lundell power motors ranging in size from one-quarter to ten horse-power; Lundell motors with six poles ranging from 15 to 40 H.P. A printing press may be seen operated by a Lundell slow speed direct-connected motor. Probably the most attractive feature of the exhibit however is the organ with the Lundell blowing apparatus. This is regularly played upon by an experienced organist. Another interesting exhibit is the automobile cab motor with Lundell controller. The dental lathe operated by the Lundell motor also attracts considerable attention. A complete line of Lundell



VIEW OF THE ELECTRICAL EXHIBITION FROM SOUTH PROMENADE.

cheering when a miniature war vessel carrying the Spanish flag is blown to atoms speaks well for the patriotism of the coming generation. The other features of interest however, such as Moore's chapel, Edison's ore separator, the disappearing gun, the electrical cascade, the underground trolley, electricity in wax, the electrical forge, the theatrophone, the galvanoplastic work and diamond making, never fail to draw a crowd or elicit exclamations of wonder and admiration. This certainly would seem to testify to the fact that the managers of the Exhibition have done their work well, and that both the exhibitors and the public appreciate their efforts. As there are now but comparatively few days left before this Exhibition—unquestionably the best of the kind ever held in this country—closes, we would strongly advise all those who have not as yet taken in this show, and are within easy reach of New York, to visit it while they have the opportunity.

power. Thus the "Duplex" has virtually double the life of an ordinary incandescent lamp, as after one filament has given out the other may be used. The Fostoria Lamp Company has grown to be one of the largest lamp manufacturers in the United States as a result of turning out a high grade of goods. The company is ably represented at the Electrical Exhibition by Mr. H. Still on Hart, the Eastern representative, whose office is at 726 Broadway, New York.

The Crouse-Tremaine Carbon Company has a complete exhibit of all kinds of carbons. Seventy-two bundles of plain and coppered, solid and cored, are arranged in pyramidal form on the left of the booth. The carbons are also displayed in actual operation in several different makes of lamps about the building, the enclosed carbons especially being favorably commented upon. A complete line of motor and generator brushes is also shown.

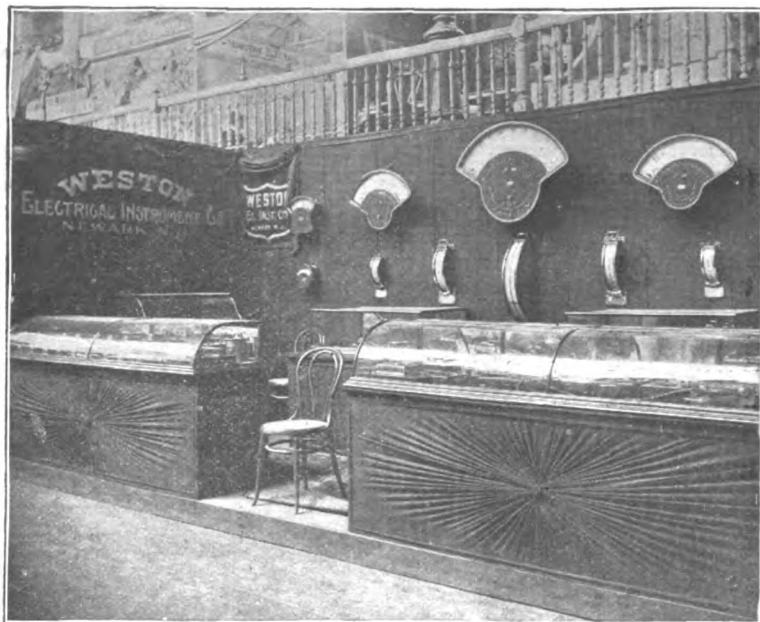
ceiling fans and column fans are also shown in operation. An automatic house elevator machine, with buttons for moving the car from one floor to another, is likewise shown in conjunction with the controlling apparatus which prevents the car from moving if the door is open.

An interesting feature of the Exhibition is the exhibit of the Columbia electric carriages built by the Pope Manufacturing Company of Hartford, Conn. These carriages, herewith shown, are the outcome of experiments exhaustively conducted during a period of three years or more, and the manufacturers, desiring to avoid every risk of putting anything of an experimental nature into the hands of purchasers, thoroughly satisfied themselves as to their entirely practical character before placing them on the market. The single seated and double seated carriages are similar with respect to speed, radius of action and general details of operation. In these vehicles

the Pope Company seems to have well realized its hopes and aims in the direction of electric automobilism. Under the most trying conditions the Columbia carriages have proved to be thoroughly satisfactory on roads accessible to ordinary vehicles in all localities where facilities for recharging the batteries are obtainable. The carriages are not

them are their laboratory standard voltmeters and ammeters, alternating and direct current voltmeters, wattmeters, ground detectors, commercial iron-cased station voltmeters and ammeters, galvanometers, etc. One of the principal features of this company's display is a well-arranged assortment of parts of instruments, which affords an excellent

least complex yet offered to the public. This firm is exhibiting one of its modern switchboards recently built for a large drygoods house in this city. On it is mounted the well-known "Ideal" circuit breaker and the La Roche self locking switches. The board is not only beautiful in appearance, being made of Knoxville gray marble, but is extremely substantial



WESTON ELECTRICAL INSTRUMENT COMPANY'S EXHIBIT.

recommended by the manufacturers for extreme long distance work or for touring, but are apparently perfectly adapted for service in the field for which they were designed, and they have given and are giving the highest satisfaction in actual use in this field for all ordinary purposes of business or pleasure.



COLUMBIA ELECTRIC CARRIAGE.

The makers have not confined their experiments and investigations in horseless traction to electricity, but are convinced that at the present stage of motor vehicle development the Columbia carriages, with their practically noiseless action, absolutely safe



COLUMBIA ELECTRIC CARRIAGE.

operation and perfect ease of control, come very near to being the ideal automobiles.

The Weston Electrical Instrument Company's exhibit, located on the main floor to the right of the Madison avenue entrance, as will be seen by the accompanying illustration, is handsomely arranged and attractively decorated. The company is displaying a complete line of its well-known measuring instruments and appliances. Prominent among

opportunity of studying the construction of the numerous types of instruments manufactured by this widely known concern. These parts also afford an object lesson illustrating the care and exactness with which every detail, however minute, has been worked out.



SPRAGUE ELECTRIC COMPANY'S EXHIBIT.

owing to its being mounted on heavy angle iron frames with brass pedestals. The bus bar work on the rear shows the high class of work this firm is in the habit of turning out. Another switchboard is also shown containing "Ideal" circuit breakers ranging in size from 25 to 2,000 amperes, with both



F. A. LA ROCHE & CO.'S EXHIBIT.

An exceedingly attractive and complete exhibit, and one of the first, if not the first, to get in running order at the opening of the show, is that of F. A. La Roche & Co., herewith shown. This company's booth is handsomely decorated and is lighted by the well-known La Roche alternating and direct-current arc lamps, which have the reputation of being not only the most substantial, but the

single and double pole. The management report that the firm is extremely busy, it being necessary to run the factory 18 hours a day to supply the constantly increasing demand for their improved circuit breaker. As we stated last week, the exhibit of this company at Madison Square Garden is in charge of Messrs. A. E. Wells, F. A. La Roche and J. A. Loutey.

A MAGNETIC BALANCE FOR WORKSHOP TESTS OF PERMEABILITY.*

BY PROF. J. A. EWING, F.R.S.

The author believes that the want is felt of a workshop instrument for making tests, in an easy and rapid fashion, of the magnetic permeability of cast and forged metal for dynamo magnets.

His own permeability bridge†, introduced two years ago, and now somewhat extensively used, allows the B-H curve for a given bar to be determined with very much less trouble than is needed to carry out ballistic tests. For the accurate comparison of one bar with another, throughout a wide range of magnetizing forces, the permeability bridge is entirely suitable, and it furnishes as simple a means of performing that operation as can well be had. The author uses it systematically in his own testing, and is thoroughly satisfied with it as a means of determining the B-H curve. But the complete B-H curve is really more than the dynamo builder or the steel founder generally wants to know. For his purpose it would often suffice to find the induction produced by some one (fairly high) value of the magnetizing force. That information is a sufficient index of the character of the specimen to allow judgment to be passed on its suitability for use in the field magnets of a dynamo.

These considerations have led the author to develop another testing instrument, which, while it tells less about specimen than can be learnt by means of the permeability bridge, gives the most useful information in a still more easy way. To use it requires no knowledge of electrical testing, and the results need no working out. The value of the magnetic induction, in the usual units, corresponding to a single stated magnetizing force, is directly read off on a divided scale.

The instrument is a magnetic balance of the traction type, making use of the principle already applied in magnetic testing in apparatus designed by Prof. S. P. Thompson, Mr. Gisbert Kapp and Prof. H. Du Bois. In most apparatus of this kind the specimen has taken the form of a turned bar with a faced end on which the pull due to magnetization was exerted. In the author's balance this facing of the end is not required, the magnetic pull being exerted between the side of the turned bar and a magnet pole which it touches, and from which it is pulled away. The specimen is a turned rod $\frac{1}{2}$ of an inch in diameter and 4 inches long. It lies across the two poles of a U-shaped electro-magnet, which is excited by a constant current of such strength as to produce a magnetizing force in the rod of about 20 C.G.S. units. In one of the poles there is a V notch for the bar to rest in, and the other pole has a slightly convex surface, being curved to form a portion of a cylinder with its axis perpendicular to the direction of the length of the rod. The side of the rod touches this pole at one point only, and the tractive force at this point of contact is the force which is measured. A lever or weigh-beam is applied to pull the rod away from this pole, while the other end of the rod remains in the V notch in the other pole, forming what may be called a magnetic hinge. The tractive force is measured by means of a weight which slides along the graduated weigh-beam.

When the rod is put in place, the current is reversed once or twice, to wipe out any residual effects of previous magnetization. The weight is then moved along the beam until the beam just drops each time it is raised, so as to bring the side of the rod into contact with the pole.

The rod requires no preparation beyond turning it to the proper diameter. Its cylindrically turned side touches the convex pole-face in a perfectly definite manner, and the rod may be taken out and

put back without altering the character of the contact. The lever is arranged in such a way that the rod always touches the same point of the pole-face.

The value of the magnetizing force to be brought to bear on the rods under test was fixed at about 20 C.G.S. units for the following reasons:

At forces much weaker than this the B-H curves of different specimens often cross; in other words, the order of merit often changes when the force is varied. But the author's experience in testing dynamo steel leads him to the conclusion that with forces of 20 units and over there is no serious change in the order of merit of various specimens. If a piece is good when $H = 20$, it remains good under stronger forces; if it is only fair when $H = 20$, it remains only fair; and a specimen that has relatively low permeability under this force does not take a materially better place when the force is increased. On the other hand, any considerably stronger force would be less convenient for testing, especially because the difference between good and bad specimens would become less well marked, and the sensitiveness of the test would consequently be reduced. The author has selected 20 as a force which on the one hand is sufficiently low to make the distinction wide between bad and good specimens, and on the other hand is sufficiently high to make the order of merit substantially the same as is maintained under stronger forces.

From the measured induction at $H = 20$ the probable induction at higher forces can be inferred with some confidence. By examination of the results of tests of a very large number of samples of dynamo steel, including the published tests of Mr. Parshall,* as well as his own tests, the author has prepared the following table, to show the probable approximate values of B at forces of 25, 30, 40 and 50 C.G.S. units, when the value of B at a force of 20 is known. The values of B found for $H = 20$ range, in dynamo steel, from 16,000 in the very best specimens down to 12,000 in specimens of decidedly low permeability. About 15,000 is representative of good dynamo-steel castings, and anything below 14,000 may be pronounced poor:

TABLE I.

Probable Values of Magnetic Induction, B, for Various Amounts of Magnetizing Force, H.

Magnetizing force, H.	Magnetic Induction, B.				
20	12,000	13,000	14,000	15,000	16,000
25	12,700	13,700	14,600	15,500	16,350
30	13,300	14,200	15,100	15,900	16,600
40	14,200	15,000	15,700	16,400	17,000
50	14,900	15,600	16,300	16,900	17,400

The range of the new magnetic balance extends (for $H = 20$) from 12,000 up to something over 16,000. It will test at the top of its range the very best samples that are found, and at the bottom of the range it will test steel of poorer quality than would be accepted for use in dynamo magnets.

The scale is a linear one, in which equal divisions correspond to equal differences in B, for a constant value of H. It is graduated to give by direct reading the values of B for $H = 20$. This uniform graduation is arrived at in consequence of the fact that with different specimens the magnetizing force is not quite constant, although the current in the electro-magnet is constant. A specimen of high permeability increases the induction in the magnetic circuit, and consequently causes a larger share of the magnetomotive force to be used in that portion of the circuit which lies outside of the specimen itself. Hence the induction in the specimen is less high than its greater permeability would imply; in other words, the better specimen is exposed to a somewhat less magnetizing force than the worse specimen is exposed to. The

tractive force increases more rapidly than in simple proportion to the actual induction; but matters are so arranged that the lessening of the induction which comes about in the way just stated compensates for this, and the observed differences of tractive force, as measured throughout the range of the scale, stand in simple proportion to the differences in the values of B which the various specimens would exhibit if the force H were constant. In other words, a scale of equal parts on the weigh-beam corresponds to equal differences of B under a constant magnetizing force, and the weigh-beam is accordingly lettered to read B directly in equal divisions. The readings give B for $H = 20$, although in consequence of the action just explained the actual magnetizing force is barely 20 for rods of very good quality, and somewhat exceeds 20 for rods of lesser permeability. The scale is adjusted by the maker by selecting values of the sliding weight and of a fixed weight on the weigh-beam which will bring the readings into agreement with the known values of B in certain standard rods.

A single standard rod is supplied with each instrument, and the observer adjusts his current until the tractive force on that rod is such that the sliding weight stands at the place on the beam corresponding to the known value of B which a force of 20 C.G.S. units produces in that standard. The standard rod consequently serves instead of an amperage-gauge, and no other current-measurer is required. A rheostat is provided in the instrument for regulating the current, and a single small storage cell forms the necessary battery. The observer puts in the standard rod, and turns the rheostat until he finds that the weigh-beam just drops each time it is lifted, while the sliding weight indicates the known value of B. He then puts in the rod which is to be tested, and finds the position which the sliding weight has to take for it, no change being made in the current. The constancy of the current is checked at the end of the tests by again putting in the standard rod.

The weigh-beam lifts the rod by means of a V-shaped stirrup close to the pole-piece from which it is to be pulled away. When the rod is pulled away the beam comes immediately against a stop which limits the motion. A hinged piece is provided under the far end of the weigh-beam, to hold it up while a rod is being taken out or put in. The weigh-beam can readily be lifted out of the way when it is desired to clean the pole-faces, and care has to be taken to keep them, as well as the side of the rod where it touches them, free of dust and rust.

In the following table a comparison is made, for a number of rods of different qualities, of the values of B known to be produced by a magnetizing force of 20 units with the values as measured by this magnetic balance. The known values of B were determined by means of the permeability bridge, by comparing each rod with a standard whose B-H curve had been found in the first instance by ballistic tests. The range covered by these examples is as wide as is likely to be met with in the practical testing of dynamo steel:

TABLE II.

Calibration of the Balance.

Induction, B, at $H = 20$, determined from Independent Measurements.	Induction, B, read from Balance.
13,300	13,280
13,400	13,400
14,310	14,360
14,350	14,290
14,600	14,470
14,900	14,960
15,100	15,060
15,080	15,150
15,570	15,650
15,800	15,720
16,000	16,000

These tests relate to different specimens, all tested with one constant current in the magnet of the balance. The agreement between the scale readings

* Advance copy of paper read before the Institution of Electrical Engineers, London, May 12, 1896.
† Described in the author's paper on "The Magnetic Testing of Iron and Steel," *Min. Proc. Inst. C. E.*, May, 1896. See also *The Electrician*, May 8, 1896.

* *Min. Proc. Inst. C. E.*, May, 1896.

and the known values of B is satisfactory. The same tests may be exhibited graphically, the readings of the balance being plotted against the known values of B for $H = 20$. They show that within this range of B the values of the induction (under constant H) are fairly represented by the readings on the uniformly divided scale of the balance. Such irregularities as occur lie equally, so far as can be judged, on both sides of the straight line. The readings of the balance may be accepted as giving values of B for $H = 20$ at least as accurately as these are required in the uses which the balance is meant to serve.

THE DISTRIBUTION OF ELECTRICAL ENERGY IN PARIS.

BY J. LAFFARGUE.

The following is a reprint of an article appearing in the Paris supplement of the *Contract Journal* for April 20, 1898:

The distribution of electrical energy in Paris dates only from the commencement of 1889. It was not until the end of 1888 that the Municipal Council of Paris granted concessions to certain companies. At this period, however, there already existed in Paris a certain number of private installations; and in 1887 Messrs. Mildé and Clero had established in the Rue du Faubourg Montmartre distributing works on a small scale which were subsequently absorbed by the Edison Company.

The main conditions imposed upon the concessionaire companies were as follow: The authority to lay cables in Paris was granted for 18 years; the mains were everywhere to be underground. The grantee was free to regulate his own tariffs on condition of not exceeding the charge of 14.4d. per kilowatt-hour for lighting, and 6d. for motive power and various applications. The municipal dues amounted to \$4 per annum for every kilometer or fraction of a kilometer of conduits laid beneath the pathways, and also 5 percent. on the returns, this last to be ascertained either by the amount of the bills or by the indications of the meters. The area to which the distribution was to extend was to have the form of a sector, passing from the center to the circumference. Consequently upon these conditions, adopted by the Municipal Council in 1888, three companies commenced the distribution in 1889—viz., the Edison Continental Company, the Société d'Éclairage et de Force par l'Électricité, and La Compagnie d'Air Comprimé d'Électricité. Simultaneously the city of Paris established, at the Halles Centrales, municipal works for the supply of lighting to the markets and to other subscribers in the district. In 1890 a new company was established under the name of the Society for the Sector of the Place Clichy, and it undertook the distribution in another quarter. Subsequently, in 1892 and 1895, two other companies were formed, that of the Champs Élysées sector and that of the Sector de la Rive Gauche.

At the present time, therefore, the distribution of electrical energy is undertaken within Paris by six concessionaire companies and by the municipal works at the Halles.

CONSIDERATION OF THE VARIOUS DISTRIBUTING NETWORKS.

We will now pass on to review the different distributing networks, while indicating the peculiarities of each.

The Edison Continental Company.—The Edison Company carries out the distribution of electrical energy in one of the finest quarters of Paris, including the Boulevards and the Place de l'Opéra. The distribution is by three-wire feeders in ring circuits, with 120 volts between each, and by continuous currents. The distribution is effected by naked copper cables supported on porcelain insulators fixed in concrete conduits; these latter are lined with slates.

The central stations are two in number—one at

No. 8 Faubourg Montmartre and the other at No. 11 Avenue Trudaine; these two works are connected together. There is also a sub-station for accumulators—38 Rue Saint-Georges. A third station, although specially used for the lighting of the Palais Royal, is also connected to the works in the Avenue Trudaine. When working, these three works are connected in parallel.

The station in the Rue du Faubourg Montmartre contains four Belleville boilers, yielding 1,600 lbs. of steam per hour; also four other boilers of the same type, giving 2,100 kilos of steam per hour at the same pressure—i. e., 210 lbs. The steam-engines are five in number, of which two are Corliss horizontal engines of 300 HP., making respectively 45 and 62 revolutions per minute. Two are vertical triple-expansion Weyher and Richemond engines of 300 HP. at 132 revolutions per minute, and one is a Willans engine of 700 HP. at 300 revolutions per minute. Each of the four 300-HP. engines drives by belting two Edison dynamos of 100 kW., with eight poles, at 130 volts and 350 revolutions per minute. The Willans machine is directly connected to a Fives-Lille dynamo of 450 kW. at 230 volts. At the works there are also two batteries of 70 accumulators of the Société pour la Travail de Métaux,

with a discharge of 700 amperes. These accumulators are charged during the daytime, the number being varied according to the potential difference of distribution. A booster is placed in series with the charging feeder when necessary. This booster consists of a dynamo of 390 amperes at 90 volts, coupled direct to an electric motor of 99 kW., running at 700 revolutions per minute.

The Palais Royal station was originally intended to supply the Palais Royal, the Cour des Comptes and the Comédie Française Theater. The company has laid a cable which allows of their works being connected with those above mentioned by placing boosters in series so as to allow of coupling up in parallel. In these works are located nine Belleville boilers, giving 4,100 lbs. of steam per hour at a pressure of 170 lbs.; also seven vertical steam-engines, yielding 190 HP. These are of the triple-expansion type. Each of these drives by means of belting a dynamo yielding 100 kW. at 130 volts and 390 revolutions per minute.

The Continental Company is one of the most important of those supplying electrical energy in Paris. At the close of 1897 it had an available power of 3,300 kW. in machines and 420 kW. in accumulators. On March 31, 1897, the company had con-

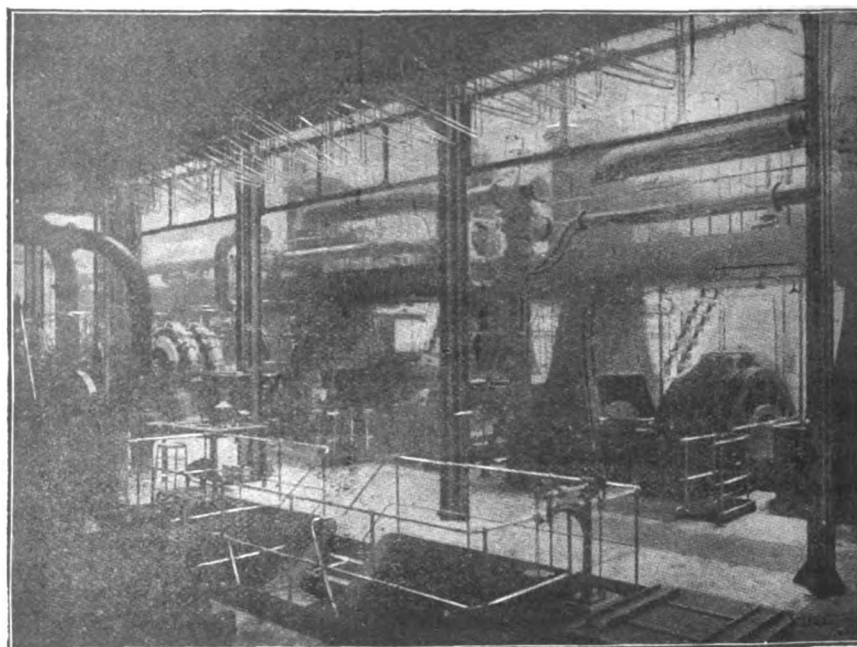


FIG. 1.—INTERIOR VIEW OF ELECTRICITY WORKS AT THE AVENUE TRUDAINE, PARIS.

having a capacity of 3,000 ampere-hours, and a maximum rate of discharge of 1,000 amperes. The switchboard is installed on the first floor, in a room above the engine-room.

The central station of the Avenue Trudaine, as shown in Fig. 1, is by far the most important. It occupies a large area. It includes nine Belleville boilers, of which three give 6,600 lbs. of steam per hour, and six give 8,000 lbs. under a pressure of 210 lbs. The steam-engines are six in number, of which four are by Weyher and Richemond, vertical, triple-expansion, of 300 HP., at 132 revolutions per minute, and two Corliss, Bonjour system, of 750 HP., at 105 revolutions per minute. The 300 HP. machines each drive directly two Edison dynamos of 100 kW. with eight poles, giving 130 volts. The Bonjour engines each work a Brown dynamo with two commutators and two sets of brushes, giving 600 kW. at 130 volts. The dynamos are placed between the two vertical cylinders. Fig. 1 gives a general view of the machine room. The meters and distributing apparatus are placed in a room on the first floor. It is from this room that the feeders proceed.

A sub-station is established in the Rue Saint-Georges at the registered address of the Edison Company. In one of the rooms are two batteries of 74 Tudor cells, having a capacity of 3,000 ampere-hours

neoted 113,346 incandescent lamps distributed amongst 1,812 subscribers. In the course of 1896 it distributed 2,555,550 kilowatt-hours at the average price of 10.3d. On December 31, 1896, it had on only 27 motors of 33 kW. for various uses, and 22 motors for lifts of 65 kW. power.

Société d'Éclairage et de Force par l'Électricité.—This company effects the distribution of electrical energy in Paris by means of sub-stations fed from the general central station of Saint-Ouen, which is outside Paris, and by various stations in the interior of Paris. The central station of Saint-Ouen (Fig. 2) is used to supply continuous current to a certain number of workshops in its neighborhood. It also supplies electrical energy to Saint-Denis and Asnières, and to several feeders for Paris, notably that for the Northern Railway terminus, and that for the Boulevard Barbès. An installation for transmission by two-phase currents is also provided for the supply of the Landy terminus outside Paris, and of the La Chapelle terminus in Paris. The Saint-Ouen central station is furnished with 10 tubular boilers of the Roser type, yielding 4,400 lbs. per hour at the pressure of 170 lbs., and also with four sets of two Leconteux and Garnier horizontal engines of 150 HP., coupled with a single flywheel, and with two

single-cylinder Garnier engines, each of 350 HP. The eight 150 HP. horizontal engines work by various countershafts eight Marcel Deprez continuous-current double-ring dynamos, yielding 72 KW. at 2,500 volts, four Hillairet 30 KW. dynamos for excitation, two Gramme 36 KW. dynamos for excitation, and one 24 KW. dynamo giving 1,200 volts for arc lamps in series. The two single-cylinder engines of 350 HP. each work a Hutin and Leblanc alternator of 250 KW. at 88 volts, with a frequency of 42 periods per second. By means of transformers the outgoing currents are raised from 88 to 6,000 volts.

The continuous current at 2,500 volts is transmitted to the works at the Boulevard Barbès in Paris, where five Marcel Deprez double-ring motors actuate directly 10 generating dynamos, of which six are of the Edison type, of 44 KW. at 175 volts, and four are Bréguet dynamos of 45 KW. at 150 volts. At these works there is also a battery of 70 accumulators of the Société pour le Travail des Métaux, yielding 3,300 ampere hours with a current of 500 amperes. The continuous current from the Saint-Ouen works is also transmitted to a station at 183 Faubourg Saint-Denis, to work two rotary transformers similar to the preceding ones. At the same works are also located two Belleville boilers and one

Desroziere dynamo of 97.5 KW. at 130 volts, at 160 revolutions per minute, and one works by belting a similar dynamo at 260 revolutions per minute; and a Laval turbine of 300 HP. working two Desroziere dynamos. The works contain also a battery of 70 accumulators, of a capacity of 2,000 ampere hours. In the La Villette station there are two Belleville boilers, two vertical steam engines similar to the above-mentioned of 150 HP., two Desroziere dynamos of 97.5 KW., and a battery of accumulators of 70 cells yielding 1,400 ampere hours. The station at the Abattoirs, having machinery of 200 KW. capacity, is specially used to supply electrical energy within the Abattoirs.

The stations of which we have just spoken—those of the Rue de Bondy, of the Rue d'Alexandrie, of the Faubourg St. Denis, of the Boulevard Barbès, and of the Quai de la Loire—are all connected in parallel for the supply of a distributing network of two conductors. From each of the works proceed a certain number of feeders which are connected at various points with the distributing network. The generating machines of the rotary transformers, or the apparatus in connection with the transformers for diphasé currents, receiving the current after transformation, are connected in parallel with the bus

mitted by continuous currents from the St.-Ouen works.

The Société d'Eclairage et de Force has now commenced to adopt another system. It has undertaken the transmission of energy by diphasé currents, using the alternators of Hutin and Leblanc and the special transformers of the same makers. The electrical energy supplied to the Nord and La Chapelle Railways is thus transmitted. We have seen that a similar trial of this mode of transmission has been made at the central station of the Rue du Faubourg Saint-Denis.

(To be continued.)

THE ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES OF EUROPE.

BY JOHN B. C. KERSHAW, F. I. C. (LONDON).

Chapter XX.—The Electrolytic Tin Industry.

The extraction of tin from its ores by electrolytic methods has not yet been attempted on an industrial scale, though several patents have been filed relating to apparatus and processes for effecting such extraction. The electrolytic tin industry is at present confined to the recovery of the tin from tin scrap, and to the production of pure tin from raw tin by an electrolytic refining process, similar to that used for copper.

The recovery of tin from tin scrap is one of those operations for which electrolysis seems to have been specially designed, and one would expect in these modern days, when the profitable utilization of city refuse is considered a subject of primary importance, that any feasible process would meet with enormous success. This is however not the case. Many processes have been patented for the electrolytic treatment of tin scrap, and some of these are now working with successful results in Germany and France, but the number of such works is much more limited than one would have expected, and the difficulty of obtaining large quantities of the raw material at reasonable rates hampers the growth of the industry. Tin scrap contains from 3 to 9 per cent. of tin, the average amount of tin present being 5 per cent. Thus in order to obtain one ton of tin from this scrap, even supposing the whole of the tin is recovered, 20 tons of scrap must be dealt with, and where the collection and delivery of the scrap at the electrolytic works costs \$6 to \$7 per ton (as in some places is the case) the recovery process is burdened with a very heavy charge. In some localities, however, the scrap can be collected and delivered for treatment at one-tenth of this cost, and in such places, and especially in localities where other manufactures lead to the production of great quantities of clippings of tin plate, the electrolytic recovery processes have every chance of success. Three processes are at work and these may now receive brief description.

In Germany, Borchers states that several firms are recovering tin from tin scrap by electrolytic methods, though he does not specify names or localities. It is interesting to note that much scrap is being shipped to Europe from Baltimore, and it is probable that part of the supply of these German works is drawn from this source. The firm of "Goldschmidt u. Cie of Essen a. d. Ruhr" was the first in Germany to attempt the recovery of tin on a commercial scale.

No details have been published concerning the process used in the majority of these works, but it is most probably that patented by Gutensohn and further improved by Siemens & Halske, while in the case of one works in Berlin the apparatus and process patented by Smith is stated to be used. The principle of both Gutensohn's and Smith's process is the same. The tin scrap is packed into baskets made of wooden laths holding each about 140 lbs., and is used as anode in a cell containing dilute sulphuric acid as the electrolyte, and plates of tinned copper as the cathode. The acid of course attacks the iron as well as the tin of the tin scrap, but only the latter metal is deposited at the cathode, and when the acid

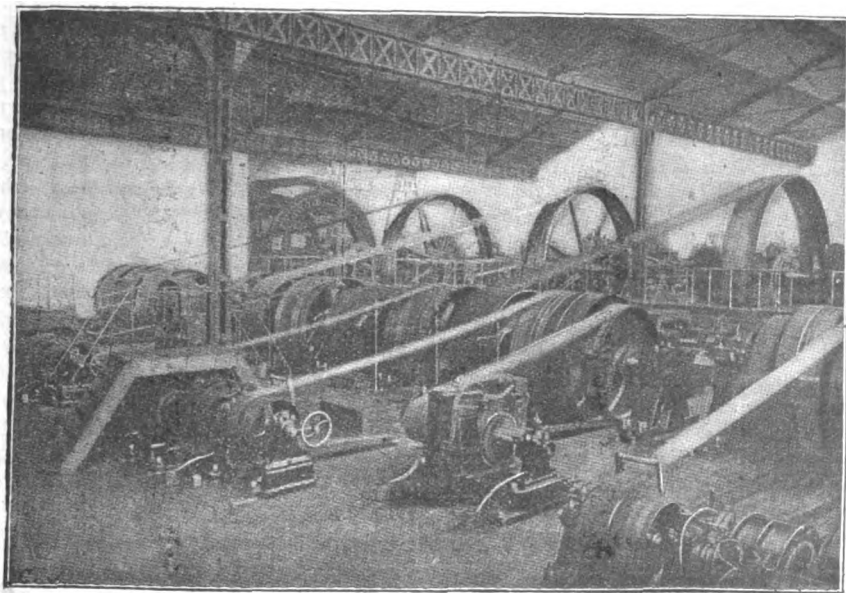


FIG. 2.—THE ENGINE ROOM AT ST. OÜEN, PARIS.

Solignac boiler, three vertical Weyher and Richemond engines of 150 HP., and three Desroziere dynamos of 97.5 KW. at 130 volts. Here also we find a battery of 70 accumulators, of 4,000 ampere hours, at 500 amperes, and a Hutin and Leblanc transformer, converting two-phase into continuous currents, fed directly from the Saint-Ouen works.

Among other generating stations in the interior of Paris there are the works at the Rue de Bondy, those at the Rue d'Alexandrie, those at the Quai de la Loire, and those at the Abattoirs. In the works at the Rue de Bondy there are four Belleville boilers, giving 3,300 lbs. of steam per hour; three Belleville boilers, giving 4,800 lbs. of steam per hour; two vertical Weyher and Richemond triple-expansion engines; one horizontal Faroot steam-engine, of 600 HP.; two Laval turbines, each of 300 HP. The different steam-engines respectively actuate two Desroziere dynamos, of 97.5 KW. at 130 volts; one Desroziere, of 400 KW. at 130 volts; and two sets of two Gramme machines, of 100 KW. at 120 volts. A battery of 75 accumulators of the Société des Métaux, having a capacity of 2,000 ampere hours, allows of a discharge of 500 amperes. The works at the Rue d'Alexandrie contain four Belleville boilers, yielding 3,300 lbs. of steam per hour; two boilers of the same manufacturer, yielding 4,400 lbs. of steam per hour; five vertical triple-expansion Weyher and Richemond engines, of which four directly actuate a

bars. The distribution is everywhere effected by means of naked copper conductors supported by porcelain insulators within concrete subways.

The Société d'Eclairage et de Force has plant at its works of 4,110 KW. capacity, of which 3,820 is from machines and 290 from accumulators. At the end of 1896 the number of arc lamps for which current was supplied amounted to 3,257, and the number of incandescent lamps was 60,594. The total length of mains extended to 51 km. The total distribution of energy for the year was 1,584,890 kilowatt-hours; the average price was 6d. per unit. The total power used for lighting amounted to 2,450 KW. The motors for various purposes numbered 134, absorbing a total power of 331 KW.; and the motors for working lifts were eight in number, absorbing a total power of 37 KW. The total power installed for the supply of motors was thus 368 KW. This company possesses in Paris, as we have seen, works of but limited capability and extent. These works were initially established in 1888 and 1889, when it was a question of lighting by electricity the Renaissance, the Ambigu, and the other neighboring theaters. They were afterwards utilized when the concession for distributing electricity was granted in 1889. At that period it was necessary to carry out promptly the electric lighting of the boulevards. At weak points of the sector it was considered sufficient to put up rotary transformers, worked by means of the power trans-

has become saturated with iron, it is run off and worked up for ferric sulphate. According to Smith, and Siemens & Halske, an EMF. of 1.9 volts suffices to provide the necessary current density; and a current efficiency of 50 per cent. is obtained. The remainder of the current is lost, owing to the concurrent action upon the iron of the anode material.

In France the recovery of tin from tin scrap is effected by a process in which caustic soda solution is used as the electrolyte. The advantage of this solvent is that it acts only on the tin, and the iron remains unattacked in the baskets containing the anode material. The disadvantages are that heat must be applied, otherwise only oxygen will be produced at the anode on passage of the current, and that 10 per cent. of tin remains in the electrolyte as sodium stannate, and cannot be deposited at the cathode by the current. The solution used in this process is stated to be a 10 per cent. caustic soda solution containing a definite proportion of common salt.

In England, Smith's process is stated by Ahrens to be at work, and in 1896 a company was registered for operating the process patented by Claus. In this process, tin scrap or any alloy of tin is used as anode material in an electrolyte containing alkaline sulphides. Sodium sulpho-stannate is formed, or the corresponding potassium or ammonium salt, and the deposition of tin from this solution is easily effected. The iron remains undissolved, and as the electrolyte requires heating during the electrolysis, the process closely resembles that in which caustic soda is used as the solvent.

The writer has written to Mr. Claus to inquire how this company is progressing, and learns that the plans are now completed for the commencement of operations upon an industrial scale, and that the process will shortly be at work.

The only factory known to the writer in which raw tin is refined electrolytically is that of Messrs. T. Bolton & Sons, Churnet Valley, Staffordshire, England. The raw tin is cast into plates suitable for use as anodes, and is placed in electrolyzing vats containing dilute sulphuric acid. A high current density is employed, and a very rough crystalline deposit of tin obtained at the cathode. The crystals can easily be detached, and are washed, dried and melted in order to prepare ingots of pure tin, which are used to coat with tin some of the classes of telegraph wire prepared by this firm at their wire-drawing works in the same neighborhood.

The cost of the energy required to produce one ton of tin by these processes can easily be calculated by means of the electro-chemical equivalent for tin, and the data already given. Taking an EMF. of 1.9 volts (for the sulpho-stannate solution this would probably be reduced) and a current efficiency of 50 per cent., the EHP. requisite to produce one metric ton tin per 24 hours will be:

$$\frac{1,000 \times 1,000 \times 1.9 \times 100}{.000,309 \times 60 \times 60 \times 24 \times 735 \times 50} = 193.8.$$

Taking the cost of the EHP. hour at \$.002, the cost of the electrical energy necessary to produce a metric ton of tin from tin scrap or any alloy of tin, will be, $193.8 \times 24 \times .002 = \9.30 .

It is thus apparent that if the raw material can be delivered at a reasonable cost at the works, the processes can be conducted with some degree of success.

Other processes have been patented for the recovery of tin from tin scrap—as for example that of Vortmann & Spitzer, a fusion process, and that of Borchers in which an electrolyte containing sodium chloride is used, but the writer is not aware that these are being worked upon an industrial scale, and therefore a description of them cannot be included in this series of chapters.

The future of the electrolytic tin recovery processes would appear to depend entirely upon the facilities offered for the collection of tin scrap at a low cost, and it is possible that in the future, when the collection and utilization of city refuse is placed

upon a more scientific basis than is at present the case, the industry will develop into one of considerable importance.*

A TRIUMPH OF SCIENCE.

The following account of a method for liquefying hydrogen, which recently appeared in the *New York Sun*, will be interesting to many of our readers:

LONDON, May 13.—The latest triumph of science—the liquefaction of hydrogen—has been briefly announced in the *Sun's* cable despatches. There is already a controversy as to where the credit belongs for first bringing into control this last and most fugitive of the elements. The Polish scientist Olszewski forestalled the discovery a year or two ago by determining accurately the critical temperature and boiling point of hydrogen, but he did not succeed in reducing the gas to liquid form in a really practical way, so that it could be examined and its properties tested. This has now been done for the first time by Prof. Dewar, and most interesting are the discoveries which are certain to develop from experiments made at the inconceivably low temperature of minus 205° centigrade. This is within twenty or thirty degrees of absolute zero, and is a point or condition in which matter undergoes astonishing changes in all its characteristics.

Prof. Dewar explained his latest researches at a meeting of the Royal Society this week, and his disclosures were received with extraordinary interest. Two or three years ago Prof. Dewar showed that a jet of hydrogen could be used to cool bodies below the temperature that could be reached by the use of liquid air; but all attempts to collect the liquid in vacuum vessels failed. The type of apparatus used in these experiments worked well, and it was therefore resolved to construct a much larger liquid-air plant, and to combine with it circuits and arrangements for the liquefaction of hydrogen. On Tuesday a start was made with hydrogen cooled to —205° centigrade, and under a pressure of 180 atmospheres, escaping continuously from the nozzle of a coil of pipe at the rate of about ten or fifteen cubic feet per minute, in a vacuum vessel, double silvered, and of special construction, all surrounded with a space kept below —200° centigrade. Liquid hydrogen began to drop from this vacuum vessel into another, doubly isolated by being surrounded with a third vacuum vessel. In about five minutes twenty cubic centimeters of liquid hydrogen were collected, when the hydrogen jet froze up from the solidification of air in the pipes. The yield of liquid was about 1 per cent. of the gas. Five gallons were produced in an hour. Hydrogen in the liquid condition is clear and colorless, showing no absorption spectrum, the meniscus being as well defined as in the case of liquid air.

The liquid must, in Prof. Dewar's opinion, have a high refractive index and dispersion, and the density must be in excess of the theoretical density—0.18 to 0.12—which we deduce respectively from the atomic volume of organic compounds and the limited density found by Amagat for hydrogen gas under infinite compression. Prof. Dewar's old experiments on the density of hydrogen in palladium gave a value of 0.62 for the combined body. Not having arrangements at hand to determine the boiling point, he made two experiments to prove the excessively low temperature of the boiling fluid. In the first place, if a long piece of glass tubing, sealed at one end and open to the air at the other, is cooled by immersing the closed end in liquid hydrogen, the tube immediately fills with solid air where it is cooled. The second experiment was made with a tube containing helium—a rare gas which has hitherto resisted all attempts to effect its liquefaction. Two years ago, arguing by analogy of the

*The writer has recently learnt that in some large towns old tins are being collected and sold for the manufacture of box clips. This method of utilization will, of course, tend to prevent the extension of the recovery processes.

molecular weights of fluorine and oxygen, Prof. Dewar suggested that the volatility of hydrogen and helium would probably be found close together. A specimen of helium which had been extracted from Bath gas was sealed in a bulb with a narrow tube attached, and was placed in liquid hydrogen, when a distinct liquid was seen to condense.

From this result it would appear that there cannot be any great difference in the boiling points of helium and hydrogen. All known gases have now been condensed into liquids which can be manipulated at their boiling points under atmospheric pressure in suitably arranged vacuum vessels. With hydrogen as a cooling agent we shall get within 20° or 30° of the zero of absolute temperature. No one can predict the properties of matter under zero of temperature. Faraday liquefied chlorine in the year 1823. Sixty years later Wroblewski and Olszewski produced liquid air, and now, after fifteen years' interval, the remaining gases, hydrogen and helium appear as static liquids.

A SPECIAL PRIZE OFFER.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For Electricity's Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and whenever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all these submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we would like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not perfectly clear, we will be pleased to answer any inquiries relating to this matter.

LEGAL NOTES.

Messrs. Enricht and Hirsch, promoters of the Canon City & Cripple Creek Electric Railroad Company, who were arrested at the instance of some of the directors of the company on the charge of embezzlement, and who have been adjudged not guilty, state that they intend to prosecute their accusers. Mr. Enricht publishes the following statement in the Florence, Col., *Refiner*: "We will each bring suit in the sum of \$200,000 against the directors of the Canon City & Cripple Creek Electric Railroad Company, including Mr. J. B. Orman of Pueblo. Our attorneys Messrs. Thomas M. Patterson and J. H. Maupin, are preparing the papers in the case now. We being residents of another State, suit will be brought in the United States Court of Arapahoe county." Messrs. Enricht and Hirsch will also, it is said, ask for the appointment of a receiver for the company.

After hearing argument on a rule to show cause why a writ of certiorari should not be issued, carrying to the Supreme Court the action of the city council of Atlantic City, N. J., in awarding a five-years' lighting contract to John H. Rothermel of Reading, Pa., Justice Garrison decided to grant the writ, making it returnable in June. The ground on which the writ was asked for and granted was that the bids were irregularly received. There are several other reasons to be advanced at the final hearing.

At a crossing of an electric railroad and a steam railroad, the latter is held, in New York & G. L. R. Co. vs. New Jersey E. R. Co., (N. J.) 38, L. R. A. 516, to have the right of way and the right to run at as high a rate of speed as it chooses, while the electric company is subject to the rule applicable to other travelers on a highway requiring them to look and listen for an approaching train.

In the United States Court at Macon, Ga., on the 14th inst., Judge Speer passed an important order with reference to the sale of the electric light plant of the Macon Gas Light & Water Company. Instead of allowing the plant to be sold to the Macon & Indian Spring Street Railroad Company for the \$40,000 which that company offers, the judge orders it sold to the highest bidder in front of the court house door on May 31, and no bid to be considered if less than \$40,000.

The Mutual Electric Light Company of San Francisco, Cal., has asked for a mandate of the courts to compel the Supervisors to accord to the company equal advantages with its rival, the San Francisco Gas & Electric Light Company. The complaint alleges that the Mutual Company has applied for permission to erect poles in order that the necessary wires may be stretched, but that the Supervisors have failed to respond to the petition one way or another; that the yearly contract for lighting streets and public buildings will be let in July; that the plaintiffs are prepared to furnish light at rates that would save the city \$40,000, but that they are prevented from doing this public service because the Supervisors have failed to grant permission for the erection of the necessary poles.

Judge Shipman of the United States Circuit Court of Appeals for the Second Circuit, New York, has handed down a decision in the case of the Sprague Electric Railway & Motor Company against the Union Railway Company. The case was first tried in the Circuit Court for the Southern District of New York, the appeal being taken from that court's decision, which adjudged that the defendants had infringed claims 2, 6 and 9 of Letters Patent No. 324,892, dated August 25, 1895, and issued to Frank J. Sprague, for an improved electric railway motor. The defendants' motor is made in accordance with Letters Patent No. 546,560, dated September 17, 1895, and issued to Sidney H. Short. Judge Shipman held that the Circuit Court's decree should be modified, with costs of the Court of Appeals to the appellants, by limiting the infringement and the accounting to claims 2 and 6, and the case is remanded to the Circuit Court, with directions to enter a modified decree in accordance with the foregoing opinion, with costs of that court.

Judge Townsend of the United States District

Court at New Haven, Conn., on the 19th handed down a decision in the case of the Electric Car Company of America and the Thomson-Houston Company against the Hartford & West Hartford Railroad Company. The plaintiffs claimed an infringement of patent on a controlling switch for electric motors. The decision orders an injunction and an accounting.

SOCIETY NEWS.

American Institute of Electrical Engineers.

At the annual business meeting of the Institute held on the 17th inst., briefly noticed in our last issue, the annual report of the council was presented, including the financial statements of the treasurer and secretary. Officers of the Institute for the ensuing year were elected as follows:

President—Arthur E. Kennelly.

Vice-President—Robert B. Owens, William Stanley, Cary T. Hutchinson.

Managers—Herbert Lloyd, Samuel Sheldon, George F. Sever, Charles P. Steinmetz.

Secretary—Ralph W. Pope.

Treasurer—George A. Hamilton.

At the meeting of the Executive Committee, the following associate members were elected:

Felix Louis Cadon, Washington, Ind.

Thomas Dempster, Schenectady, N. Y.

Paul Lesheule, Electrical Engineer, commissioned by French Government, Schenectady, N. Y.

Livingston Johnson, Jr., Islip, N. Y.

Howard Joelyn, Seattle, Wash.

James J. Mahony, New York City.

Irving A. Taylor, Brooklyn, N. Y.

Wallace Rupert Turnbull, East Orange, N. J.

James H. Winfield, New Glasgow, N. S.

Fred W. Wool, Los Angeles, Cal.

The following associate members were transferred to membership:

Edward Burch, Minneapolis, Minn.

G. A. Redman, Rochester, N. Y.

L. S. Boggs, Ogden, Utah.

Gustave J. Fischer, Sydney, N. S. W.

James B. Scott, Baltimore, Md.

The New York Electrical Society.

The annual meeting for the election of officers of the New York Electrical Society will be held in the Concert Room, Madison Square Garden, on Thursday, May 26, at 8:15 P. M.

At 8:30 Prof. Sidney H. Short will lecture on "The Outlook for Heavy Electric Traction." Prof. Short has devoted himself for many years past to the subject of Electric Traction, and his work constitutes some of its most interesting chapters. On this occasion the lecture will be illustrated not only by lantern slides but by kinetoscope and will serve as a complete summary of the situation.

The Trans-Mississippi Exposition.

The great fair bearing this title will open at Omaha, Neb., at noon June 1. A parade, for which great preparation is making, will precede the exercises at the Exposition buildings. Precisely at noon President McKinley will be placed in telephonic connection with the officials of the Exposition and his message will be read before the assembled people on the grounds. The President will touch the button that will start the Exposition machinery in motion. From all accounts the Exposition will be one of the finest displays of the kind seen in the United States. A great deal of attention has been given to the electrical department, under the supervision of Prof. R. B. Owen, who has labored incessantly for several months to make it fully representative of the electrical industry in its scientific as well as its mechanical developments. Mr. Luther Stieringer has had control of the electric illumination of the buildings and grounds, and is said to have surpassed all his previous efforts in the effects produced.

CANADIAN NOTES.

A deputation from the city of London, Ont., has been in Ottawa to ask the Dominion Government to grant a bonus of \$100,000 to aid the construction of the proposed electric railway from London through Stratford, Arcona and Thedford, connecting with the Canadian Pacific and Grand Trunk railways.

The Eugene F. Phillips Electrical Works of Montreal have been awarded the contract to supply all the trolley, bond and feed wire required in the construction of twenty-five miles of electric railway at Jamaica, W. I.

The shareholders of the Hamilton, Grimsby & Beamsville Electric Railway of Ontario held their quarterly meeting recently. The quarterly financial statement showed an increase of 10 per cent, in gross earnings over those of the corresponding period last year. The directors were empowered to issue debentures to pay off the floating debt of \$20,000. The present debenture debt of the road is \$85,000, payable in thirty years.

The British Columbia Electric Railways Company of Victoria, B. C., are having installed a complete plant for developing the water power at Goldstream, for operating the street railway and the electric light plant. The work is being done under contract by Hasson & Hunt, mechanical engineers, of San Francisco, Cal., and the plant is expected to be in operation by midsummer. The power house will be stationed at Goldstream, about twelve miles from Victoria. The contracts for the electrical and hydraulic machinery have been closed, and the construction is being pushed with rapidity. The electrical apparatus will be of the Canadian General three-phase type, using rotary converters and transformers to distribute over the line as the two-phase with a capacity of 11,000 volts. Two Pelton water wheels will be used, with a capacity of 600 horse power each, delivering 1,000 horse power in Victoria. Provision is also being made for 600 additional horse power if required. The power delivered in Victoria will be sufficient to operate the street railway, electric lighting system, commercial and municipal, and also to furnish considerable power for the operation of stationary motors for manufacturing purposes, elevators, etc.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Argos, Ind.—An effort is to be made to complete the electric railway between Argos and Danville this summer. The line will touch Bourbon, Lake Maxinkuckee and Winamac. Dr. Sears, of Plymouth, is at the head of the enterprise.

Atlantic City, N. J.—"Wars and rumors of wars," says the "Atlantic City Review," "have no effect upon the trolley interests in this State. That syndicate having the heavier purse takes the franchise, however, and the one now operating in Camden, with its \$3,000,000, soon will possess all the roads necessary to make connection with Atlantic City. But this concern was fox; it will not file its papers of incorporation until after it has an option on a necessary territory for the advancement of its system."

Boston, Mass.—The committee on street railways of the Legislature will report a bill embodying substantially all the recommendations of the special committee on the relations of street railways to cities and towns, except the recommendation that the tracks should be owned by the municipality. An important section is that the corporation tax shall be distributed where the track is located instead of where the owners of the stock live.

Chicago.—It is said that when the Illinois Central Railroad Company substitutes electricity for steam on its suburban lines in this city it will adopt the gravity system for stopping and starting trains. By this system the tracks are elevated at all stations, giving a suitable grade, the trains standing at stations with brakes. Upon receiving the starting signal the motorman releases the brake, and the train starts by force of gravity. Approaching the next station when the train meets the incline the motorman throws off the power. The train loses its momentum and is brought to a standstill at the station by the brakes.—The South Side Elevated is now operating one-half of its cars by electricity.

Cooperstown, N. Y.—Ground has been broken and the work begun of building the first five miles of the trolley road known as the Greene County Traction Company line. The ties and poles have been distributed along the route through to West Coxsackie. The road will run from Coxsackie to Middleburg, through Greenville, Oak Hill, Durham and a branch to Windham in

the Catskills. The purpose of the road is for freight and passenger traffic.

Dover, Del.—The Senate has passed a bill requiring trolley companies to deposit \$500 per mile before commencing to build their roads. The trolley roads are to be permitted to occupy public roads by obtaining the consent of the local authorities, and grade crossings are permissible where they are unavoidable.

Greenville, S. C.—J. A. McCullough, attorney, representing himself and others, has applied for a franchise to build a street railway in this city. The council granted an option of sixty days to the petitioners in which to give a guarantee that the road will be built.

Jersey City, N. J.—The North Jersey Street Railroad Company has issued its rates for special cars in anticipation of the opening of the trolley party season. There are a large number of places within the trolley area extending from Jersey City towards all points of the compass, and trolley parties have therefore a variety of routes to choose from.

Lansing, Mich.—The directors of the Lansing, Dexter & Ann Arbor electric road met here on the 17th inst. and placed more of the \$250,000 stock. Arrangements are about completed for commencing work at this end of the line within a fortnight.

Lockport, N. Y.—The Lock City Electric Street Railway will be sold under mortgage foreclosure proceedings at the Niagara County Courthouse in this city on June 8. The sale will be conducted by Frederick Charman of Niagara Falls. The sale will probably be a simple formality to clear the title to the road and equipments, as it is said the road is already practically the property of the Ely syndicate, which will operate the electric railway system between this city, Buffalo and Olcott.

Marion, Ind.—The Indiana Traction Company, building an electric line from Marion to Elwood via Alexandria, has secured the right to operate over the lines of the Elwood Street Railway Company. It was a coup on the rival line, the Union Traction Company.

Norwich, Conn.—A huge trolley enterprise is reported that involves a continuous line between Norwich and Worcester, running almost parallel with the Norwich and Worcester steam railroad. It will require the co-working of five companies, three in Connecticut and two in Massachusetts. One of the companies is about to build a link of the proposed line from Putnam, Conn., to East Thompson, Conn., under an existing charter, and the plans have been drawn for the rest of the line in Connecticut, and petitions filed in Massachusetts.

Oxford, Mass.—The selectmen have granted a franchise to the Worcester & Webster Street Railway Company to run their cars through Oxford en route. The company will build its power house near Carbone's pond in Oxford, which is a place convenient to the whole road.

Rochester, N. Y.—It is understood that arrangements have been made for building the long talked of electric railway that is to connect Solus Point with this city. Charles Van Vorhis, Ira Luddington and James C. Tone of Rochester have held a conference with the business men of Solus with the result that they have been able to announce that the road would surely be built.

Sedalia, Mo.—The Sedalia Electric Railway & Light Company on the 17th inst. disposed of its entire plant to an Eastern syndicate for \$350,000, and F. W. Child of New York has been appointed general manager, with headquarters in Sedalia. The electric railway owns fifteen miles of track, one park of 40 acres and another of 130 acres, while the lighting plant operates 100 arc and 200 incandescent lights. Extensive improvements are to be made at once.

Springfield, O.—B. V. Randalls and Herbert Forgy, of New Carlisle, have been looking over the ground, accompanied by the county commissioners, with the view of building an electric road from St. Paris via New Carlisle to Dayton.

St. Louis.—The Broadway cable road is, it is said, to be converted into an electric line if the company succeeds in getting a franchise from the council for certain proposed extensions of the line.

Staunton, Va.—A syndicate of widely known professional and business men propose to develop the Seawright Spring property by erecting a sanitarium, and hotel on the grounds and making the place generally attractive. An electric road will be built to establish connection with the main lines of travel. It is expected that a meeting of the men composing the syndicate will be held at Staunton the latter part of this month.

LIGHTING PLANTS.

Bay City, Mich.—The electric light committee of the council has been instructed to see what can be done toward improving the city's commercial lighting plant. Superintendent Cornish recommends the purchase of another incandescent dynamo, an exciter and a switch-board.

Bellaire, Mich.—The village council has taken action looking toward the establishment of an electric light plant.

Brooklyn, N. Y.—Bids will be opened at the office of the Department of Public Buildings, Lighting and Supplies, 346 Broadway, on May 31, for furnishing, operating and maintaining electric lamps for the year

1898, for lighting such of the streets, parks and public places in the borough of Brooklyn of the city of New York as may be determined upon by the commissioner of public buildings, lighting and supplies after the estimates are opened.—Vice-President Corbin, of the Manhattan Beach Hotel & Land Company, Limited, has been informed officially by the Government authorities in charge of the harbor and its defenses that no order had been, or would be issued requiring the extinguishment of lights at night in the hotels or residences on the shores of New York Bay.

Charlotte, N. Y.—The board of trustees has fixed June 2 as the date for opening bids for the sale of \$35,000 worth of bonds to be issued for the purpose of putting in an electric light plant and waterworks. The light bonds, amounting to \$10,000, will be made separate from the waterworks bonds.

Chicago.—The Chicago Edison Company will soon have control of the entire lighting business of the city. For some time negotiations have been in progress to consolidate the eleven independent concerns under the Commonwealth Electric franchise which a few months ago was purchased by the Chicago Edison people. It is not part of the programme to merge any of the outside companies into the Chicago Edison, but to form an entirely new corporation. This new corporation, however, will be as much under the control of the Chicago Edison Company as if it were a part of it.

Huron, O.—The village council has set June 20 as the date for awarding the contract for the construction of the electric light plant.

Huntsville, Ala.—The new power-house of the Huntsville Electric Company will be completed June 1. The capacity of the old plant has been necessarily doubled, the company having secured a contract from the city to furnish a double number of electric arc lights.

La Grange, Ind.—Judge Wilson has issued an order requiring the court rooms to be lighted by electricity.

Mitchell, S. D.—The electric light plant was totally destroyed by fire on the evening of the 15th inst. The estimated loss is \$7,000, with no insurance. Mr. Clemenger, the owner, says he will rebuild immediately.

Milwaukee, Wis.—Sealed proposals will be received at the office of the Board of Public Works, this city, until Thursday, June 2, at 10:30 o'clock A. M. for furnishing all the materials and doing all the work necessary and required to construct and install an electric light and power plant in the Public Library and Public Museum building in the city of Milwaukee, according to plans and specifications on file in the office of the board.

New Haven, Conn.—Mayor Baker of Providence visited this city last week to investigate the lighting system. He is on a trip through New England collecting statistics on the cost of lights in different cities.

Providence, R. I.—The directors of the Narragansett Electric Lighting Company, after due consideration of the proposition presented by the city council committee on underground wires, have practically decided to agree to the provisions of the city measure providing for placing the wires underground.

Quincy, Ill.—At a recent meeting of the city council J. C. Hubinger, of Keokuk, was granted franchises for gas and steam heating and electric lighting. He was recently granted a franchise for an electric line of street cars in the city, and the last two franchises were granted upon the condition that he shall carry out his contract with the city for building the electric street car line. The heating franchise is granted for thirty and the electric lighting for twenty years, and he is allowed sixty days for accepting the ordinance and is required to commence the work ninety days thereafter. He is bound to give greater facilities and cheaper rates for electric lighting than now exist in the terms of the two established companies in the cities.

San Bernardino, Cal.—The local correspondent of the Los Angeles "Herald" writes to that paper that "there is a new system of furnishing the incandescent light that is said to be much cheaper than the present one, and capitalists have been here to investigate the chances for putting in such a plant in this city. While not giving out their plans for publication, yet they seem to think this an excellent place to locate such an establishment."

Syracuse, N. Y.—About 100 lights are to be added under the new law to those already in operation. This adds \$10,000 to the lighting fund, which is now \$100,000. It is said that the Syracuse Gas Company will compete for these new lights.

Trenton, N. J.—The Governor has signed the Crispin Electric Pole bill, which legalizes franchises granted by municipalities to electric light companies. The bill was subject of much discussion before the Legislature, and its opponents claimed that it conferred upon electric light companies power to plant poles wherever they pleased. The Governor maintained that it does not extend any privileges not contained in the original franchises.

MANUFACTURING, ETC.

New York.—We learn from the "N. Y. Commercial" that the Sprague Electric Company, of No. 20 Broad street, has just shipped an immense quantity of electrical material to London, Liverpool, Hamburg, Rotterdam and other European cities. Over \$12,000 worth went to London, \$20,000 worth to Hamburg, \$9,000 worth to Rotterdam, while over \$68,000 worth was for Buenos Ayres. The Sprague Company has just shipped to Lon-

don an automatic elevator which was constructed for the Grosvenor square residence of Mrs. Caroline Astor Haig, formerly Mrs. Coleman Drayton. It was shipped by the Wilson line, and is now being put in the house. Mr. Sprague secured the contract against keen competition from the English engineers. Every particle of the equipment, car finish, ropes and all, was made in this country. The elevator has the same control system as will be used in the elevators which the Sprague Company will construct for the Brooklyn elevated railroad.

Philadelphia.—The ordinance giving the United States Time & Weather Service Company permission to erect meteorological and time columns in this city and to connect them with underground wires has been referred to the electrical committee by the sub-committee without any recommendation, and on motion the measure was laid aside.

Pittsburg, Pa.—The "Commercial Gazette" states that an important enlargement is about to be made to the arc lamp department of the Westinghouse Electric & Manufacturing Company at East Pittsburg.

TRANSMISSION PLANTS.

Marysville, Cal.—An experiment concluded here by Dr. F. A. C. Perine of Stanford University, for utilizing the electrical power line of the Yuba Power Company from their power-house to Brown's Valley, a distance of ten miles, has resulted in demonstrating that 36,000 volts may be transmitted over a copper wire using glass insulation against 16,000 which has been the maximum in practice in power transmission heretofore. The result of the experiment will be to effect a saving of half the cost of wire in the construction of electrical transmission plants in future. The exact loss in transmission of this high current has not as yet been made known.

COMPANY MATTERS.

Albany, N. Y.—At a meeting of the directors of the Albany, Helderberg & Schoharie Electric Railway Company, held here lately, measures were taken to adjust the differences that had arisen in the company, and it is probable that the construction of the road will be proceeded with. The "Express" states that a Mr. Burgett of Boston, and Mr. Schermerhorn of New York, who are backing the company financially, are satisfied that the project will succeed now that the differences have been amicably settled. It will cost \$1,250,000 to construct the road. The road will be about 44 miles in length if it is continued to Middleburg—five miles beyond Schoharie.

Binghamton, N. Y.—The stock of the Binghamton Gas & Electric Company, valued at \$360,000, has been transferred to E. C. Brown, of New York, who purchased the plant for Emerson McMillin & Co. of that city. William G. Phelps, who held a controlling interest in the concern, conducted the negotiations preliminary to transferring the plant to the New York owners.

Montpelier, Vt.—A committee appointed by the Montpelier board of trade and the owners of the charter of the Mad River Valley Electric Railroad have taken a trip over the projected route and conferred with the people in the various towns interested in the enterprise. The incorporators already have 200 shares subscribed. The road would open up a large lumbering and farming country and there are valuable soapstone quarries along the route. The charter members of the railroad are H. O. Ward of Moretown, T. J. Deavitt of Montpelier, F. C. Kennedy, J. J. Flynn, A. O. Humphrey of Burlington.

Philadelphia.—The directors of the Citizens' Street Railroad Company of Indianapolis met in this city on the 14th inst., and re-elected W. W. Kurtz vice-president, and W. K. Mulholland of Indianapolis secretary and treasurer. No nomination was made for president. The board met again on the 10th of June.

Sandusky, O.—L. S. Baumgardner, receiver of the Put-in-Bay Water Works, Light & Railway Company, has applied to the United States Court at Toledo for leave to lease the railway property by public outcry. The lease is to be from June 1 to October 1, the lessee to put the property in proper shape and make necessary repairs and improvements at his own expense, such repairs and improvements to become the property of the company.

Troy, N. Y.—It is stated that the directors of the Troy City Railway Company and those of the Albany Railway Company have under consideration a proposition for the consolidation of the roads. The proposition is understood to have originated in Albany, and, while it has not met with positive approval here, is said to have the sanction of many stockholders. The argument is advanced by those favoring the scheme that such a combination would reduce operating expenses and facilitate travel between Troy, Lansingburgh, Cohoes, Waterford, Watervliet and Albany.

ELECTRICIANS IN THE WAR.

At Cincinnati, T. C. Haston, a civil engineer, and W. M. Goodale, an electrical engineer, have recruited a company of electricians, linemen, telegraph operators and other skilled men, and have offered their services to the Government.

President McKinley on the 19th inst. sent to the Senate the nomination of Eugene Griffin to be Colonel of the First Regiment Volunteer Engineers. Mr. Griffin is the originator of the recent movement looking to the formation of a corps of electrical engineers. In the

electrical business he had attained prominence as First Vice-President of the General Electric Company.

Julius Buerastaele of Manitowoc, Wis., left that place a few days ago to accept the position of electrical engineer on one of the United States naval vessels. The salary which he will receive is only half of what he received from the Manitowoc Electric Light Company, which position he could have held indefinitely.

PERSONAL AND MISCELLANEA.

George F. Haggerty, a manufacturer of electric bells and annunciators for hotels and flat houses, with a factory at 201 East Forty-seventh street, New York, died on the 16th inst. at his home in Fifth avenue of Bright's disease. He had been on a business trip South and was taken ill while on his way home.

Joseph McArdle, an electrician, while repairing some wires in Washington, D. C., on Thursday afternoon last, received a shock from the effects of which he died soon afterwards. He was 28 years old and unmarried.

Electrician George Tully of 135 East Thirty-sixth street, New York, was taken to Bellevue Hospital last week for treatment for an attack of hiccoughs which began several days before. The hiccoughs were so severe that he could neither sleep nor eat but the doctors at Bellevue at last accounts had succeeded in relieving him.

Frank Callahan, an employee at the Salt Lake City Water & Electric Power Company's Jordan Narrows plant, was recently found drowned and parboiled in the hot springs about two miles distant from the plant. The springs are entirely unimproved, and the mud is very deep in places, while the water is exceedingly hot. It is supposed that Callahan got into the mud and could not get out. The water where he was found was near boiling temperature, and the man's body was terribly scalded. Callahan was a native of Dubuque, Ia., 28 years of age, and had been in the employ of the power company since March 28. He was formerly employed by the Big Cottonwood Power Company.

A license has been obtained by a Birmingham (Eng.) firm for the manufacture of a patent continuous current electric motor for transmission of power. The principal advantage claimed for this motor is in the circular form of the magnet, which not only uses the material to the best advantage but also provides a framework for the machine and a metallic casing for the armature and field coil. The commutator is sufficiently enclosed to preserve it from ordinary accident, yet is open enough to render it easily accessible for the adjustment of brushes, etc. In order to have a uniform and constant lubrication of the spindle, the motor is fitted with two brass rings which dip into the oil and hang upon the shaft of the motor at each bearing. When the motor is in operation the rings revolve slowly and carry round a sufficient quantity of oil. The starting switches and resistance are fireproof. A fuse is also provided, which melts if too great a load is placed upon the motor.

I. R. Nelson has tendered his resignation as superintendent of the Milwaukee, Racine & Kenosha Electric Railway Company to take effect on June 1. Mr. Nelson will be succeeded by John Blatt of Cleveland, O., who assisted in the construction of a portion of the line.

The winner of the first prize for speed and accuracy in receiving and typewriting telegraph messages at the telegraph tournament at the Electrical Exposition was H. V. Emanuel of Philadelphia. Mr. Emanuel received fifty messages in thirty-two minutes. The average length of the messages was fifteen words, necessitating a frequent change of blank on the typewriter. Referring to the feat the Philadelphia "Record" says: "The prizes, \$100 in cash and a Remington Sholes typewriter, are a source of great gratification to Mr. Emanuel, as, in addition to receiving them for speed and accuracy, he was commended for the neatness of his copy. Mr. Emanuel was born in Philadelphia on November 27, 1869, and is in his twenty-ninth year. He entered the employ of the Western Union Telegraph Company when 15 years of age. From his boyhood he has had a predilection for telegraphy and from the time he entered the company's employ has applied himself to his favorite study. He has had a practical experience in the business and states that his proficiency is the result of close application and what he has learned was gleaned in the office, never having attended a school of telegraphy. Mr. Emanuel has a cozy home at Bryn Mawr, where he spends the time when off duty with his estimable wife."

RECENT COMPANY ELECTIONS.

Bay County Electric Light Company, Bay City, Mich.—Directors: E. T. Carrington, C. F. Eddy, Benjamin Godkin, M. Haggarty, J. L. Stoddard, O. A. Eddy, D. W. Case.

Cincinnati & Hamilton Street Railway Company, Hamilton, O.—President, William Christy, Akron; treasurer, F. J. Pomeroy, Cleveland; secretary, C. E. Hooven, Hamilton; directors: J. C. Hooven, George Rentschler, James Christy, William Christy, F. J. Pomeroy, F. J. J. Sloan and J. F. Hogan.

Consolidated Street Railway Company, Worcester, Mass.—President, Francis H. Dewey; director: Albert H. Stone; both to succeed the late Charles B. Pratt, who was president of the company and also a director. There will be no other changes in the management of the road.

Consolidated Electric Company, Denver, Col.—President, E. W. Rollins; vice president, A. S. Hughes; general manager, John H. Poole; secretary and treasurer, T. H. Reynolds; directors: A. S. Hughes, H. T. Rogers, F. A. Keener, E. L. Foster, J. H. Poole, T. E. Poole, T. H. Reynolds, G. H. Taylor, A. E. Greer, E. W. Rollins and H. K. Devereaux.

Hudson Electric Light Company, Hoboken, N. J.—President and general manager, E. D. Mullen; treasurer, C. R. Dougherty; secretary, H. M. Francis; superintendent, A. H. Bonta.

Leavenworth Electric Railroad Company, Leavenworth, Kan.—Manager, E. E. Coombs; directors: Newman Erb, New York; H. N. Smith, Boston; W. D. Beihel, Denver; E. Summerfield, Lawrence, Kan.; E. E. Coombs, Leavenworth.

Manchester Street Railway Company, Manchester, N. H.—President, W. A. Tucker of Boston; treasurer, Philip L. Saltonstall of Boston; clerk, Judge J. W. Fellows; general manager, Edwin P. Shaw, Jr.; directors: W. A. Tucker, Walter M. Parker, Charles T. Means, Philip L. Saltonstall, Edwin P. Shaw, Jr., N. H. Walker, who has acted as superintendent of the road for several years, will be retained in the same capacity.

Mechanic Falls Water, Electric Light & Power Company, Mechanic Falls, Me.—President, Horace Purington; vice-president, H. C. Rowell; treasurer, L. A. Moulton; clerk, H. F. Sands; directors: Horace Purington, H. C. Rowell, L. A. Moulton, Percival Bonney, S. S. Wat-rhouse.

COMMERCIAL PARAGRAPHS.

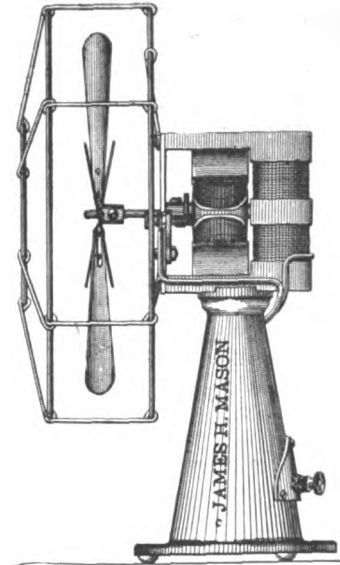
The Jersey Electric Company's Renewed Lamp has become so popular that they are unable to purchase enough burnt out lamps to fill orders. Anyone having any to sell would do well to write them for cash prices paid for same. See advertisement on page v.

The Warren Electric & Specialty Company of Warren, O., the well-known manufacturers of High-Grade Anti-Trust Incandescent Lamps, are nothing if not original. Their advertisements are usually unique and masterpieces. With this company's attractive advertisements, coupled with the fact that the lamps made by the concern cannot be surpassed in life, candle power or brilliancy, they should not lack for orders.

The American Stoker Company, now established in commodious quarters in the magnificent new Washington Life Building, Broadway and Liberty street, New York, have just issued a new catalogue which is ready for distribution. The company has spared no expense in the production of this catalogue, and its illustrations, typography and arrangement speak well for the tact and taste of its compilers. In a card announcing the issue of the catalogue the company says: "A man is known by the company

he keeps' is regarded as an axiom. Apply this axiom to Stokers, then note the firms whose plants are reproduced in our catalogue. We think you will unite with us in agreeing that the American Stoker moves in pretty good society."

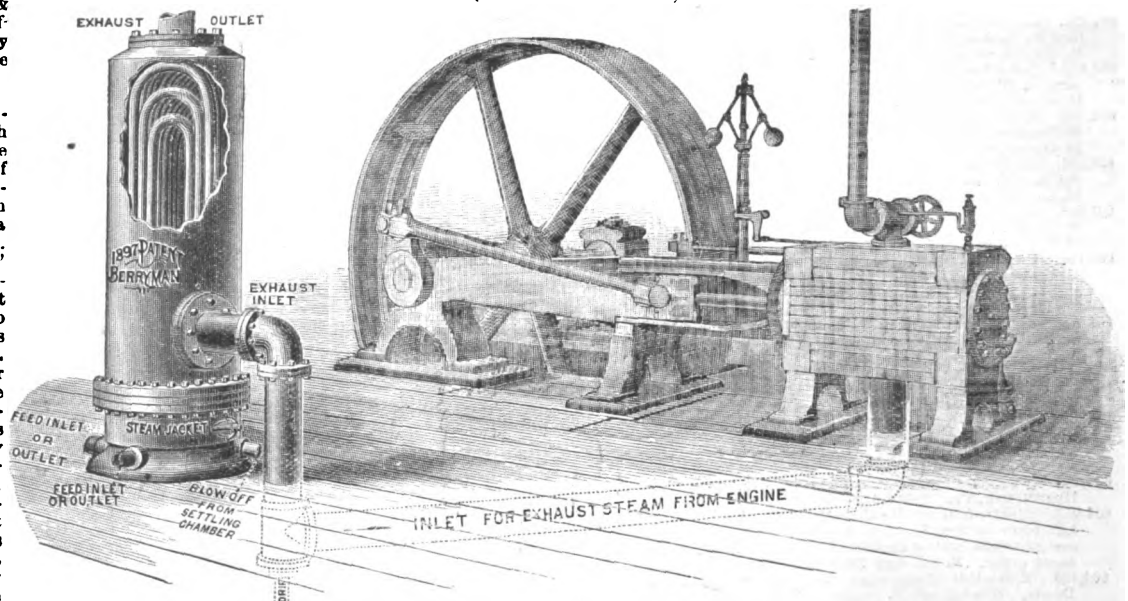
We would call our readers' attention to the advertisement of James H. Mason which appears in this issue. Mr. Mason is the patentee of the well-known Mason Electric Fan Motor, with offices at 152 East 23d street, New York. The Electric Portable Fan outfit which Mr. Mason manufactures is attractive in appearance, light, durable and so simple in construction that it can easily be handled, and cared for even by a child. This fan motor has moreover been so designed that any danger from shock is entirely eliminated. It is extremely economical in operation and



may be run for 15 hours at an actual cost of ten cents. No acids are required for the battery as the latter is made to generate current through the medium of a battery salt and water. As one of these electric motors, mounted on a stand with 8 inch four-bladed fan and guard, including battery, costs but \$10, they should find a ready sale. Mr. Mason also manufactures a small motor for power purposes which is extremely well thought of and in great demand.

THE IMPROVED BERRYMAN.

(KELLEY'S PATENT.)



ONE OF THE MANY METHODS OF CONNECTING KELLEY'S PATENT IMPROVED BERRYMAN FEED-WATER HEATER AND PURIFIER.

THE IMPROVED BERRYMAN

is a LITTLE GIANT at heating water and keeping steam boilers clean and free from scale. It is the product of long and varied experience of the firm of Benj. F. Kelley & Son of this city of over 16 years with the well-known "old style" Berryman, which they are still manufacturing in connection with their other specialties, which are Improved Economical Power Pumps, the Standard Feed-Water Heater and Kelley's Improved Exhaust Pipe Heads.

Any information, catalogues and prices may be obtained by applying direct to the main office of the firm, Benjamin F. Kelley & Son, at 91 Liberty street, New York City.

ON EXHIBITION

during the Electrical Show in the Generating Department a 800 Horse-Power Improved Berryman Feed-Water Heater and Purifier, furnishing hot water to a large battery of steam boilers.

This heater is rapidly superseding the "old style" Berryman, owing to its much greater compactness, higher efficiency and durability.

At the space occupied by the firm are exhibited the Berryman Heaters, "Old Style" and Improved, and their marked difference is causing many comments among the visiting mechanical engineers. Mr. Geo. Ernst, a representative of the firm, has charge of the exhibit.

INCORPORATIONS.

The Ephrata Electric Railway Company, Ephrata, Lancaster County, Pa. Capital stock, \$15,000. Directors: F. E. Bailey, Philadelphia; S. N. Bailey, Dillsburg; A. W. Mentzner, H. G. Mentzner, J. W. Von Neida, Ephrata.

The Detroit Light & Land Company of Detroit, Becker County, Minn., has filed amended articles of incorporation, by providing that the company may do a general real estate business as well as furnish electric lights to the Detroit people.

The Suffolk Gas & Electric Light Company of the towns of Islip and Babylon, Suffolk County, N. Y. Capital stock, \$200,000. Directors: Charles F. Street, Hunter Wykes and William B. Hord of New York City.

The Maranacook Electric Light & Power Company, Augusta, Me.—to supply the towns of Winthrop and Readfield with gas and electricity for all purposes. Capital stock, \$10,000. President, Frank Ridlon of Dorchester, Mass.; treasurer, John A. Hamblin of Augusta; clerk, L. A. Burleigh; directors: Frank Ridlon, John A. Hamblin and Joseph Williamson, Jr.

The Key West Electric Company, Key West, Fla.—to carry on a general electric business at Key West. Capital stock, \$300,000. Incorporators: Harry E. Knight of Westfield, N. J., and David J. Newland and William E. Knight of New York City.

The Seaside Park Light, Water & Sewer Company, Camden, N. J. Capital stock, \$100,000. Incorporators: William J. Bradley, Camden; Harry Reeves, Gloucester, and Francis R. Fishian, Bridgeton.

The Washington Lighting Company of New Hampshire has filed articles of incorporation with the Secretary of State at Concord, N. H. The company controls the new "Washington light" for the State of New Hampshire. Capital stock, \$300,000. Incorporators: Frank H. Sargent, Victor A. Grant, Sherburne J. Winslow and William S. Lougee of Pittsfield and Frank A. Dearborn of Boston.

The Consumers' Electric Company, Elizabeth, N. J. Incorporators: George F. Chapman of Elizabeth, and W. J. Davis, W. E. Connor and Charles McArthur of Jersey City.

The Diamond Electric Company, Peoria, Ill., has certified to an increase of capital stock from \$50,000 to \$100,000.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 17, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

604,098. Rail Conductor for Electric Systems. Louis E. Watkins, Springfield, Mass., assignor of one-half to Francke W. Dickinson, same place. Filed Aug. 18, 1897.

604,196. Trolley for Electric Railways. Sidney H. Short, Cleveland, O. Filed Sept. 26, 1896.

604,097. Street-Car Fender. James E. A. Walker, Walkerton, Canada. Filed May 21, 1897.

604,171. Fender or Guard for Tramway-Cars. Joseph Leighton, Reading, Pa., assignor of three-fourths to Jacob Shaaber, same place, and Edward Leighton, Harry Leighton and Adrien Leighton, Conshohocken, Pa. Filed July 27, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

604,081. Electric-Lighting System for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Sept. 16, 1897.

604,082. Electric-Lighting System for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Sept. 22, 1897.

604,083. Electric Lighting Apparatus for Railroad-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Sept. 25, 1897.

604,084. Electric-Lighting Apparatus for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Oct. 11, 1897.

604,085. Electric-Lighting Apparatus for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Oct. 14, 1897.

604,101. Electric-Lighting Apparatus for Cars. Edward Wilhelm and Willard F. Richards, Buffalo, N. Y., assignors to Charles M. Gould, same place. Filed Oct. 28, 1897.

604,209. Electric-Arc Lamp. Frank W. Steinacker and Edwin F. Cowley, Cleveland, O. Filed April 12, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

604,094. Telephone-Switchboard Plug. James Taylor, Heathercliffe Helsby, England. Filed Nov. 21, 1896.

604,238. Apparatus for Joining Telegraph-Cables. Henri Menier, Paris, France. Filed Dec. 28, 1897.

MISCELLANEOUS.

604,033. Electrical Safe-Protection System. Isaac Freed, Harrisburg, Pa. Filed June 15, 1897.

604,035. Electromagnet Having Rotating Fields. Walter Langdon-Davies, London, England, assignor, by mesne assignments, to the Davies-Motor Company, Limited, same place. Filed May 23, 1896.

604,128. Electrical Apparatus for Operating Elevator Doors. Humphrey E. Smith, Chicago, Ill., assignor to the Burdett Rowntree Manufacturing Company, same place. Filed April 14, 1897.

604,137. Apparatus for Electrically Working Metals. James D. Bishop, New York City. Filed May 6, 1897.

604,127. Circuit-Closer. Willis D. Kennedy, Easton, Pa. Filed March 25, 1895. Renewed Oct. 2, 1897.

604,220. Commutator-Brush Holder. William B. Stull, Bayonne, N. J. Filed Feb. 12, 1898.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

A Suit Against the Detroit Telephone Co.

The Western Electric Company (Bell Company manufacturer) has begun action in the United States District Court at Detroit to restrain the Detroit Telephone Company and Wm. L. Holmes from using a multiple switchboard in which the plaintiff claims exclusive rights under a patent upon an invention of Leroy B. Firman, purchased by the plaintiff in 1881, and patented January 17, 1882.

With reference to the suit, President Holmes of the Detroit Telephone Company says:

"The Firman patent expires in January, 1899, and hence has only seven months more to live. The switchboard of the Detroit Telephone Company was constructed in a manner to conflict in nowise with any other patent. This, of course, was known to the Bell Company, or it would have commenced suit two years ago, when our company first started.

"It has been part of the policy of the Bell Company to try to embarrass us in every way. That company knew that our equipment was not like theirs, and hence predicted that it would not work, but it has been disappointed by our excellent service.

"The only object of the Chicago corporation in commencing this suit is to be revenged upon the citizens of Detroit who have refused to pay exorbitant telephone charges like those which this monopoly maintains in every other large city in the United States.

"While, of course, the telephone trust cannot have any hope of securing an injunction against the operation of a public franchise from any court in the United States, it does hope by these proceedings to head off, for a few months, the construction of independent telephone exchanges in other large cities."

The New Haven (Conn.) Register of the 19th inst. says: "Alois J. J. Pfeiffer, a young local electrician, sails to-morrow for France to take charge of the building of a new telegraph line from Paris to Rome. Mr. Pfeiffer is 23 years of age, and has made a brilliant success already. He graduated from Sheffield scientific school, Yale college, in '94 and immediately went to the General Electric Company at Schenectady. Later he went to Niagara Falls as an expert electrician and remained there until offered the position of chief electrician of the great telegraph line from Paris to Rome, which is controlled by a wealthy French syndicate. Mr. Pfeiffer is a brilliant young man and the news of his success will be received with pleasure by his many New Haven friends."

A public meeting was held at Washburn, Wis., on the night of the 14th inst., to protest against the excessive rates charged by the Wisconsin Telephone Company (Bell), and devise ways and means to obtain better and cheaper service. A proposition was made by the Chequamegon Telephone Company to put in 'phones and establish an exchange at a reduction of over 25 per cent. from the present rates. The proposition was accepted and the new company will begin work in a short time.

The assembly committee on streets, St. Paul., has decided to recommend for passage the ordinance granting a franchise to the American Telegraph & Telephone Company. The company proposes to give a long distance service, taking in Chicago and Eastern cities. The ordinance as amended provides that the company shall have no authority to fix its rates, if it establishes a local exchange, at a higher rate than the lowest amount charged by any competing exchange. The city council is also given full authority to regulate the business of the company within the city as it may think for the best interest of the citizens.

A Carlisle, Pa., dispatch states that Daniel Drawbaugh, the inventor, announces that the underground and submarine device for long-distance signaling on which he has been working for the past eight years or more is now in such an advanced stage of perfection that an officer of the Government will at once make a thorough inspection and test of it. Mr. Drawbaugh thinks the device would be especially valuable to the Government in the present war with Spain. He claims it will notify the operator at either end of the line the moment a person or vessel passes over it and can be worked any distance.

The Rural Telephone Company has been organized at Pleasantville, Westchester county, N. Y., with the following officers: R. S. Haviland, president; W. H. Moore, vice-president; Guy G. Norton, secretary, and C. W. Page, treasurer. The company will operate in Pleasantville, Chappaqua, Mount Kisco, Unionville and other places in the county.

The South Jersey Telegraph and Telephone Company has elected the following directors: James E. Mitchell, James Merrihew, S. M. Plush, Henry S. Huldekeper, Thomas Sherwin, John E. Hudson and O. A. Jaaks.

Rules Governing Cable Companies During the War.

The telegraphic orders given by Gen. Greely have been accepted by each of the cable companies, and now constitute an agreement with the Government. The agreement between the Government and the cable companies is as follows:

"In order to safeguard the public interests until further instructions, these companies refuse to receive or transmit the following:

"First—Any and all messages, either to or from officials of Spain or any of her colonies, except such as are addressed to or signed by the President of the United States or any member of his Cabinet, in Washington City.

"Second—All code or cipher messages to any point in the West Indies, Brazil or Venezuela, with the following exceptions:

"(a) Messages addressed to or signed by the President or members of his Cabinet at Washington.

"(b) Messages exchanged between any Ambassador or Minister of Austria-Hungary, France, Germany, Great Britain, Italy and Russia in Washington City and their duly recognized consular officials.

"(c) Messages exchanged by neutral European Governments and their consular agents, provided that such messages are officially signed and addressed.

"Third—All messages in plain or open text that on their face contain information against the United States in the present war with Spain."

In addition to these general restrictions, the cable companies at Key West, Fla., and the Haitian Cable Company in New York City, decline to receive or forward any messages communicating information as to the movements of United States naval vessels or current military operations.

The orders relating to foreign cablegrams simply emphasize the orders given when the war began, and do not relate to cable dispatches to any other parts of the world than those which are affected by the war.

The new State Telephone Company began operations at Lapeer, Mich., on the 12th inst with 125 telephones in service. Its only line at present leading from Lapeer is to Detroit. Connections are being made with all the villages in the county. The Moore Telephone Company intends forming a junction with the State Company to the north.

President Andy R. Smith of the telephone company, Rock Hill, S. C., died suddenly in the First Presbyterian Church of that town on the 15th inst. While seated in one of the pews, he was seen to suddenly throw up his hands, give a gasp and fall back over the seat. Two physicians in the church sprang to his aid, but he was dead before they reached him. Mr. Smith was also treasurer of the Electric Light Company at Rock Hill.

The American District Telegraph Company, Philadelphia, at the annual meeting on the 16th inst. elected these officers: E. J. Mathews, president; William H. Baker, vice-president; O. C. Adams, vice president and general manager; William L. Fry, secretary and treasurer; C. C. Adams, William H. Baker, E. O. Bradley, A. B. Chandler, George G. Glenn, E. J. Mathews, E. R. Mathews, E. O. Platt, W. L. Stanger, directors.

Raleigh, N. C., is now in telephonic connection with Goldsboro, and the line will be continued from Goldsboro to Newberne, and possibly to Wilmington.

The telephone line between Fort Collins, Col., and Livermore will be built immediately. The contract for furnishing and setting poles has been awarded.

The committee of the Chattanooga, Tenn., council to which was referred the two new telephone franchises have not yet agreed upon a report.

A 7,000 ton telegraph cable-laying ship is now in course of construction at Barrow, Eng.

The War Revenue bill taxes telegraph messages one cent each.

New Companies Incorporated.

The Galva Telephone Company, Galva, Ill. Capital stock, \$2,000. Incorporators: George D. Palmer, T. H. Johnson and W. A. Wigren.

The Citizens' Telephone Company, Medina, N. Y. Capital stock, \$12,000. Directors: John C. Moorhead, Cleveland; Robert J. Moorhead, North East, Penn.; Samuel B. Rawson, Elyria, Ohio; Clayton J. Rannister, Westfield; Ralph J. Quale, Silver Creek, and George H. Frost and Fred W. Plato, Buffalo.

The Conneautville Telephone Company, Conneautville, Pa. Capital stock, \$4,500. Directors: R. F. Wilcox, L. D. Carey, J. H. Smith, J. F. Snodgrass, W. J. Darby and D. E. Mewitt, Conneautville.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: cert. indbt., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen. genl., general; g. gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—May 23:						Hartford Conn.—May 23:					
Albany Ry. Co.....	100	2,000,000	\$1,750,000 1% Q. Feb. '98.	142½	145½	Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000 3% M., Jan. '18	140	--
Troy City Railway Co.....	100	2,000,000	1% Q., Dec. 10, '97	65	68	Hartford & West Hartford RR.....	100	1,000,000	247,000	--	--
Traction Co. (Saratoga).....	100	50,000	50,000	--	--	Holyoke Mass.—May 23:					
Allentown, Pa.—May 23:						Holyoke Street Ry. Co.....	100	400,000	400,000 4% A., Jan., '98.	200	205
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	--	15	Hoboken, N. J.—May 23:					
Bridgeport, Conn.—May 23:						North Hudson Co. (N. J.) Ry. Co...	25	1,250,000	1,000,000 8% M., 1892.	70	--
Bridgeport Traction Co.....	100	2,000,000	2,000,000 1% Aug., '97.	45	60	Indianapolis, Ind.—May 23:					
Baltimore, Md.—May 23:						**Citizens' Passenger Ry.....	---	5,000,000	5,000,000	24	25
Baltimore City Passenger Ry. Co...	25	6,000,000	2,500,000 5% S., July 2, '97.	71	72	Lancaster, Pa.—May 23:					
aBaltimore Consolidated Ry. Co...	25	10,000,000	9,177,000 2% S., Jan. 15, '98	22½	23½	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	--	--
Central Ry. Co. of Baltimore City...	50	800,000	800,000 6% A. Dec., 1897.	80	82½	Lancaster & Col. Electric Ry.....	---	---	87,500	--	--
Boston, Mass.—May 23:						West End Street Railway.....	---	---	---	--	--
New England Street Ry.....	25	5,000,000	1,081,925 1% Q., Jan. 15, '97	---	---	Louisville, Ky.—May 23:					
North Shore Traction Co.....com.	100	4,000,000	4,000,000	10	13	Louisville Ry.....com.	100	4,000,000	3,530,000 1½% Q., Oct., '97.	30	35
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000 6% S., A. & O.	67	72	Louisville Ry.....	100	2,500,000	2,500,000 2½% S., Oct. 1, '97.	87	94
b West End Street Ry. Co.....com.	50	10,000,000	9,085,000 1% S., Oct., '97.	82½	83	Minneapolis, Minn.—May 23:					
b West End Street Ry. Co.....8% pfd.	50	6,400,000	6,400,000 4% S., Oct. 1, '97.	103	108½	Twin City Rapid Transit.....com.	100	17,000,000	15,010,000	---	---
Boston Elevated R. R.....	100	10,000,000	---	60½	61	Twin City Rapid Transit.....7% pfd.	---	8,000,000	1,714,200 1¼% Jan., '98.	14	20
Brooklyn, N. Y.—May 23:						Montreal, Canada.—May 23:					
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,400 2% Feb. 1, 1898.	185	195	Montreal Street Ry. Co.....	50	4,000,000	4,000,000 8% S., M. & N.	250½	251
Brooklyn Rap. Transit Co., tr. certf.	100	20,000,000	20,000,000	42½	42½	Toronto Street Ry. Co.....	100	6,000,000	6,000,000 1¼% S., J. & J.	9½	96½
cBrooklyn Heights Railroad.....	---	---	---	---	---	Memphis, Tenn.—May 23:					
dBrooklyn City RR.....guar.	100	12,000,000	12,000,000 2½% Q., Jan., '98.	205	208	Memphis Street Railway Co.....	100	500,000	500,000	15	--
eBrooklyn, Queens Co. & Sub. RR.....	100	2,000,000	2,000,000	---	---	New Haven, Conn.—May 23:					
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000 1% Oct. 1, '97.	140	---	Fair Haven & Westville RR.....	25	1,500,000	900,000 4% S., Sept. '97.	60	---
Kings County Elevated.....	100	4,750,000	4,750,000	---	---	New Haven Street Railway Co.....	100	1,250,000	1,000,000 2½% A., July '96.	60	80
Kings County Traction Co.....	100	4,500,000	4,500,000 1% July 26, '97	46	18	New Haven & Centerville.....	100	700,000	800,000	---	---
Nassau Electric Railroad.....	50	6,000,000	6,000,000	---	37½	Winchester Avenue RR.....	25	1,000,000	600,000	40	42
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	---	---	New Orleans, La.—May 23:					
Brooklyn, B. & W. E. Railroad.....	---	1,000,000	1,000,000	74	80	Canal & Claiborne RR. Co.....	40	240,000	240,000 4% S., Jan., '98.	140	170
Buffalo, N. Y.—May 23:						New Orleans & Carrollton RR.....	100	1,200,000	1,200,000 1½% Q., Jan., '98.	123½	126
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	58	60	New Orleans Traction Co.....com.	100	5,000,000	5,000,000	1	2½
*Buffalo Railway Co.....	100	6,000,000	5,370,500 1% Q. Dec., '97.	80	---	New Orleans Traction Co.....pfd.	100	2,500,000	2,500,000	5	7
Columbus O.—May 23:						aCrescent City RR.....guar.	100	2,000,000	2,000,000 3% S., Jan., '98.	---	30
Columbus Street Railroad.....	100	8,000,000	8,000,000 1% Q., Feb., '98.	48	50	bNew Or. City & Lake RR.....guar.	100	2,000,000	2,000,000 4% S., Jan., '98.	81	88
Columbus Central Street Railroad...	100	1,500,000	1,500,000	---	---	Orleans Railroad.....	50	500,000	185,000 1½% S., June, '94.	16	17
Charleston, S. C.—May 23:						St. Charles Street Railway.....	50	1,000,000	1,000,000 1½% Jan., '98.	53½	54½
Charleston City Ry. Co.....	50	100,000	100,000 8% S., Jan., '97.	---	---	New York—May 23:					
Enterprise City RR. Co.....	25	1,000,000	250,000	---	---	Central Crostowntown RR.....	100	600,000	600,000 2½% Q. July, '97.	0	---
Chicago, Ill.—May 23:						cChristopher & 10th Sts. RR.....guar.	100	650,000	650,000 2% Q., Jan., '98.	164	164
Chicago City Ry. Co.....	100	12,000,000	12,000,000 3% Q., Dec. 31, '97.	246	248	Dry Dock, E. Bldg. & Battery RR...	100	1,200,000	1,200,000 1½% Q., Feb., '98	153½	155
Chicago & South Side R. T. RR.....	100	10,823,800	10,323,800	---	---	dMetropolitan Street Ry. Co.....	100	30,000,000	30,000,000 1¼% Q., Jan., '98	32	32
Lake Street Elevated RR.....	100	10,000,000	10,000,000	12½	13	eBleecker St. & Fulton Py. Ry.guar.	100	900,000	900,000 ¼% A., July, '97.	20	84
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	---	3½	fBroadway & Seventh Ave.....guar.	100	2,100,000	2,100,000 2½% Q., Oct., '97.	177	185
Met. West Side El. const. stk.....	100	15,000,000	2,500,000	---	---	gGen. Park, N. & E. Rivers RR.guar.	100	1,800,000	1,800,000 ¼% Q., Jan., '98	80	82½
North Chicago Street RR.....	100	10,000,000	6,600,000 3% Q., Jan., '98	197½	199	hEighth Avenue RR.....	100	1,000,000	1,000,000	320	325
North Chicago City RR.....	100	500,000	249,000	---	---	i42d St. & Grand St. Ferry RR.guar.	100	750,000	748,000 4½% Q., Feb., '98	92	154
South Chicago City Railway.....	100	2,000,000	1,601,200	---	---	jNinth Avenue RR.....guar.	100	800,000	800,000	190	194
West Chicago St. RR. Co.....	100	20,000,000	18,189,000 1½% Q., Feb. '98	92½	93	kSixth Avenue RR.....guar.	100	2,000,000	2,000,000 4½% Q., Feb., '98.	310	310
Chicago West Div. Ry.....guar.	100	1,250,000	621,900 35%	---	---	lTwenty-third St. E. R. Co.guar.	100	600,000	600,000 2½% Q., Jan., '98.	168	171
Chicago Passenger Ry.....guar.	100	2,000,000	2,000,000 5% S.	---	---	mThird Avenue RR.....	100	2,500,000	2,500,000 2% Q., Feb., '98.	57	60
Cincinnati, Ohio.—May 23:						n42d St. Manhattan & St. Nich. Av	100	2,500,000	2,500,000	175	200
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000	---	20	*Union (Huck)berry Ry.....	100	2,000,000	2,000,000	---	---
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000 2½% S., Feb., '98.	---	75	Newark N. J.—May 23:					
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	---	25	Consolidated Traction Co. of N. J....	100	15,000,000	15,000,000	46½	47½
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000 1½% Q., Jan., '98.	112½	118	Newark Passenger Ry.....	100	6,000,000	6,000,000	180	190
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1¼% Q., Jan., '98.	---	---	nRapid Transit Street Ry.....	100	504,000	504,000 11¼% A.	---	---
Cleveland, Ohio.—May 23:						Pittsburg, Pa.—May 23:					
Aaron, Bed. & Elev. Elec. Ry.....	100	1,000,000	1,000,000 ¼% Jan., '98	39	40	Allegheny Traction Co.....	50	500,000	500,000	---	45
Cleveland City Ry.....	100	8,000,000	7,600,000 ¼% Oct., '97.	55	60	aConsolidated Traction Co.....com.	50	15,000,000	15,000,000 2% Jan., '96.	11	14½
Cleveland Electric Ry.....	100	12,000,000	12,000,000 ¼% Q., Oct., '97	50	53	Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000 3% May, '97.	45½	45½
Detroit, Mich.—May 23:						pCentral Traction Co.....	50	1,500,000	1,500,000	---	---
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	100½	---	qCitizens' Traction Co.....	50	8,000,000	13,000,000 6% A.	60	---
Fl. Wayne & Belle Isle Ry.....	100	400,000	400,000 5% July, '96.	175	---	rDuquesne Traction Co.....	50	8,000,000	13,000,000 4% A.	---	---
Rapid Railway Co.....	---	250,000	250,000	---	100	sPittsburg Traction Co.....	50	2,500,000	1,900,000 8% Aug., '95.	---	---
Detroit Electric Railway.....	---	1,000,000	1,000,000	---	---	tFederal St. & Pleasant Valley Ry...	25	1,100,000	1,100,000 2½% Jan., '98.	23½	---
Wyandotte & Detroit River Ry.....	100	250,000	200,000	---	110	uPgh., Allegheny & Man. Trac. Co...	50	8,000,000	12,994,830 2% Aug., '95.	---	---
Dayton O.—May 23:						vTowrig & Birmingham Trac. Ry...	25	8,000,000	8,000,000 ¼% Jan., '96.	18½	18½
City Railway Co.....com.	100	1,500,000	1,470,600 1¼% Q., Jan. 1, '98.	100	102	wPittsburg & West End Ry.....	50	1,500,000	1,500,000 5% A., June 30, '97.	---	---
City Railway Co.....pfd.	100	600,000	600,000 1½% Q., Jan. 1, '98	140	145	Second Avenue Traction Co.....com.	50	4,000,000	14,000,000	---	---
People's Street Railway.....	---	1,100,000	---	---	100	Suburban Rapid Transit Co.....	50	800,000	200,000	---	---

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 b Company controls Ottizans' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 c Leased to Boston Elevated Railroad Company.
 d Owned by Brooklyn Rapid Transit Company.
 e Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.
 f Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 g Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 h Owned by Atlantic Ave. RR. and leased to Nassau system.
 i \$20 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$250,100 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k 8% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 8% on stock.
 b Leased to New Orleans Traction Company at 8% on stock.
 c Leased to Central Crostowntown Railroad at 8% on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18% on stock.
 j Leased to Met. St. Ry. for 99 years from April 30, 1892; 8% first 5 years, 8% thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1½% yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.
 p Leased to Consolidated Traction Company for 8% per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 6% on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4% on capital stock after October.
 s Leased to Consolidated Traction Company for 1% on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.
	Par	Author'd	Issued.						Par	Author'd	Issued.			
New Bedford Mass.—May 23:							Boston, Mass.—May 23:							
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2% Q., Jan. '98.	238	159	
Northampton, Mass.—May 23							Erle Telegraph & Telephone Co.....	100	...	...	1% Q., Jan. '98.	68	6 1/2	
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	...	10,894,800	10,804,800	\$1.50 %., Feb. '98.	127	...	
Omaha, Neb.—May 23:							New York.—May 23:							
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	...	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2% Q.	...	98	
Paterson, N. J.—May 23.							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	1 1/2% Q.	101	108	
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1 1/2% Q.	188	189	
Providence, R. I.—May 23.							Franklin Tel. Co.....	100	1,000,000	...	1% S.	40	44	
United Traction & Electric Co.....	100	8,000,000	8,000,000	1/2%., Jan. '98.	59	62	Erle Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1% Q., Jan., '98.	68	68 1/2	
Philadelphia.—May 23:							*Gold & Stock Tel. Co. guar. 6%	100	5,000,000	...	1% Q.	109	111	
Fairmount Park Trans. Co., \$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14 1/2	...	*International Ocean Tel. Co. guar. 6%	100	8,000,000	...	1 1/2% Q.	106	108	
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2%, July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	...	...	60	66	
Hestonville, Man. & Fairmount, 6% pfd.	50	533,900	153,900	3% S., Jan. 10, '98.	61	65	*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1 1/2% Q., Jan., '98.	142	146	
Fairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3% Feb. 1, '98.	63	66	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000	...	2% S.	78	78	
Union Traction Co., \$12 1/2 pd.	50	30,000,000	21,930,450	.....	15 1/2	16	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.	...	...
Electric Traction Co.....	50	...	8,297,920	.....	71 1/2	71 1/2	*South & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2 1/2% S.	85	...	
dCitizens' Passenger Ry.....	50	500,000	...	...	27 1/2	...	*Commercial Union Telegraph Co.	25	500,000	500,000	3% S., Jan. 1, '98.	110	113	
dFrankford & Southwark Pass. R.	50	...	11,875,000	14 share A—Apr. 97	47	...	Western Union Telegraph Co.....	...	97,870,000	...	1 1/2%., Jan., '98.	9 3/4	91 1/4	
dHigh Avenue Ry. Co.....	25	1,000,000	...	...	89	90 1/2	*Div. guar. by Postal Tel. Co.	...	...	...	...	...	...
dLombard & South Streets Ry....	25	1,000,000	1,000,000	A. & O.	235	216	Miscellaneous.—May 23:							
dSecond & Third Streets Ry....	50	10,000,000	1771,076	\$9 share A, Mar. 97	132 1/2	135	American Dist. Tel. (Phila.).....	25	400,000	...	1% Q., Feb. '98.	14	...	
dPeople's Traction Co.....	50	1,500,000	1,572,800	\$5.25 share—1898.	135	...	Bell Tel. Co. (of Canada).....	100	3,168,000	3,168,000	2% S.	170 1/2	173	
dGreen & Coates Passenger Ry.	50	500,000	150,000	3% Jan., 1898.	135	...	Chesapeake & Potomac Tel. Co.	100	...	...	...	48	...	
dPeople's Passenger Ry.....	25	1,500,000	874,000	.....	...	...	Chicago Telephone Co.....	100	...	...	...	302	...	
dPeople's Passenger Ry., pfd.	25	750,000	277,102	.....	...	...	Central Dist. Prtg. & Tel. Co. (Phg.)	100	750,000	750,000	...	68	76	
dPhiladelphia Traction Co.....	50	30,000,000	20,000,000	4% S—Oct. 1, '97.	82 1/2	82 1/2	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1% Q.	70	72	
dCaterline & Balunbridge St.....	50	1,000,000	580,000	6% A—Mar., '97.	185	...	Hudson River Telephone Co.....	50	2,500,000	2,500,000	2 1/2% Q.	112	117	
dContinental Pass. Ry., guar.	50	1,000,000	600,000	.....	...	...	*Northwestern Telephone Co. guar.	50	...	...	...	87 1/2	...	
dEmpire Passenger Ry., co.	50	1,000,000	600,000	.....	...	...	Providence (R. I.) Teleph. Co.....	50	...	...	...	120	122	
dPhiladelphia City Pass. Ry.....	50	1,000,000	1475,000	\$7.50 share July '97	175	180	Southern New Eng. Teleph. Co.....	100	8,000,000	...	...	...	...
dPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	\$3.50 share July '97	86	...								
dRidge Avenue Passenger Ry.....	50	750,000	1420,000	\$12 share July '97	475	300								
dPhiladelphia & Darby Ry. guar.	50	...	200,000	\$2 share July, '97.	...	...						
d17th & 19th Sts. Pass. Ry. guar.	50	1,000,000	250,000	1% S., July, '97.	157 1/2	...								
dThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000	\$11 sh. A., July, '97	270	...								
dUnion Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh., July '97	223	228								
dWest Philadelphia Pass. Ry.....	50	750,000	3750,000	\$10 share, July '97	240	235								
Rochester, N. Y.—May 23:														
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18								
Reading, Pa.—May 23														
Reading Traction Co.....	...	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	...								
kCity Passenger Ry.....	50	350,000	350,000	Jan., '94.	112	...								
kEast Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	...								
St. Louis Mo.—May 23:														
Fourth Street & Arsenal Ry.....	50	300,000	150,000	.....	...	...					
Jefferson Avenue Ry. Co.....	50	100,000	400,000	2% Dec., 1888.	...	...						
Lindell Ry.....	100	2,500,000	2,400,000	1 1/4% Jan., '98.	120	124								
National Railway Co.....	...	2,500,000	2,479,000	1 1/2% Jan., '98.	...	...						
Cass Avenue & Fair Grounds....	...	2,500,000	2,500,000	.....	...	...					
Citizens' RR.....	100	2,000,000	1,500,000	1% Oct., '93.	90	110								
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% Jan., '98.	95	105								
Missouri RR.....	50	2,100,000	2,300,000	1 1/2% Jan., '98.	170	172 1/2								
People's RR Co.....	50	1,000,000	300,000	50c., Dec., '89.	57	60								
Southern Electric Ry.....	50	500,000	500,000	.....	...	...					
Southern Electric Ry..... 6% pfd.	100	1,000,000	1,000,000	1 1/2% Jan., '98.	104	110								
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	51 1/2	5 1/2								
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '95.	...	175								
San Francisco, Cal.—May.														
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	...	110								
Geary Street Park & Ocean RR.....	100	1,000,000	375,000	\$2.50 share, '96.	40	50								
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	53								
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	...	8 1/2								
Scranton, Pa.—May 23:														
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12								
mScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	...								
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	...	...					
Springfield Ill.—May 23:														
Springfield Consolidated Ry.....	100	750,000	750,000	.....	...	11								
Springfield O.—May 23:														
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	...	2								
Springfield, Mass.—May 23:														
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	205	210								
Toronto Canada.—May 23.														
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	95 1/2	95 1/2								
Montreal Street Railway Co.....	...	4,000,000	4,000,000	4% S.	250 1/2	251								
Washington, D. C.—May 23														
Belt Ry. Co.....	50	500,000	500,000	.....	...	...					
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh., Oct. 97.	73 1/2	74 1/2								
Columbia Ry. Co.....	50	400,000	400,000	6% A.	75	78								
Eckington & Soldiers' Home Ry....	50	707,000	652,000	.....	8	...								
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	110 1/2	120 1/2								
Metropolitan RR Co.....	50	1,000,000	453,900	2 1/2% Q.	...	...						
Worcester, Mass.—May 23:														
*Worcester Traction Co.....	100	3,000,000	3,000,000	.....	15	17								
*Worcester Traction Co..... 6% pfd.	100	2,000,000	2,000,000	3% S., Feb., '98.	92	94								
Worcester & Suburban Street Ry...	100	550,000	512,500	4 1/2%., 1897.	84	...								
Wilkesbarre, Pa.—May 23:														
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29								

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidated. c Electric, People's and Philadelphia Traction Companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to Union Traction Co. at a rental of \$10,000 per an. in 1866-7-8, \$20,000 p. a., in 1895-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10% guaranteed by Reading Traction Company.
 n Dividend of 6% guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—May 23:													
Fort Wayne Electric Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ft. Wayne Elec Co. T. Sec. Series A.	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
General Electric Co.....com.	100	10,000,000	30,460,000	2%	Q., Aug., 1893.	35 1/2	36						
General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2%	S., July, '98.	91	94						
T. H. Elec. Co. T. Sec. Series D.	50	.....	.....	.....	.....	82	84 1/2						
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	.....	22	33 1/2						
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 1/2%	Q., Feb., '98.	52	53						
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	.....	52	53						
New York.—May 23:													
Edison Elec. Ill'g Co., New York.....	100	10,000,000	7,938,000	.....	.....	125	129						
*Edison Elec. Ill'g Co., Brooklyn.....	100	4,000,000	3,750,000	1 1/2%	Oct., '97.	108 1/2	110						
Edison Ore Milling Co.....	100	.....	.....	.....	.....	10	18						
Edison Electric Storage Co.....	100	.....	.....	.....	.....	.....	.....
General Electric Co.....com.	100	10,000,000	30,460,000	2%	Q., Aug., 1893.	35 1/2	36						
General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2%	S., July, '98.	91	94						
Interior Conduit & Insulation Co.....	100	1,000,000	1,000,000	.....	.....	41	..						
United Elec. Lt. & Pow. Co.....pfd	..	.....	.....	.....	.....	..	..
Pittsburg, Pa.—May 23:													
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	.....	127	..						
East End Electric Light Co.....	50	800,000	800,000	Q	.....	..	10						
Philadelphia, Pa.—May 23:													
Edison Electric Light Co.....	100	2,000,000	.....	.....	.....	144 1/2	..						
*Electric Storage Battery Co.....com.	100	8,500,000	.....	.....	.....	22	23 1/2						
*Electric Storage Battery Co.....pfd.	100	5,000,000	.....	.....	.....	24	25 1/2						
*Penna. Ht. Lt. & Pow. Co.....com.	50	5,000,000	.....	.....	50c. p. sh., Oct. '97	..	..				
*Penna. Ht. Lt. & Pow. Co.....pfd.	50	5,000,000	.....	.....	6% Oct., '97.	..	..				
Northern Elec. Light & Power Co.....	10	6,500,000	550,000	\$325,000 dis.	Jan. 11 '97	18 1/2	14						
Southern Elec. Light & Power Co.....	10	187,500	187,500	.....	.....	10	..						
Miscellaneous.—May 23:													
Brush Electric Co.....	50	.....	.....	.....	.....	37 1/2	40						
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	.....	13	18						
Missouri-Edison (St. Louis).....com.	25	.....	.....	.....	.....	..	14						
Eddy Electric Mfg. Co.....	25	.....	.....	.....	.....	125	128						
Hartford (Conn.) Elec. Light Co.....	100	850,000	.....	.....	.....	6	11						
Hartford (Conn.) Lt. & Power Co.....	25	175,000	.....	.....	.....	160	..						
New Haven (Conn.) Elec. Lt. Co.....	100	100,000	.....	.....	.....	83 1/2	85						
Narragansett (Prov., R.I.) Elec. Co.....	50	1,200,000	.....	.....	2% Q., Oct., '96.	110	120						
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	.....	110	150 1/2						
Royal Elec. Co. (Montreal).....	..	1,000,000	.....	.....	2% Q	133 1/2	133 1/2						
Toronto (Canada) Elec. Light Co.....	100	1,085,000	1,085,000	1 1/2%	Q	100	100						
Thomson-Houston Welding Co.....	100	.....	.....	.....	3% S., Dec. 1, '96.	100	100						
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	.....	100	100						

PASSENGER RAILWAY.

*With Interest

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—May 23, 1898.						
Fourth St. & Arsenal St. Ry. 1st mtg. 6a.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 5a.	400,000	400,000	1906	M. & N.	100	102
Lindell Ry. Co. 1st mtg. 5a.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co. 1st mtg. 5a.	1,000,000	700,000	1916	M. & S.	106	107
Mount City RR. Co. 1st mtg. 6a.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6a.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7a.	75,000	75,000	1902	M. & N.	97	100
People's RR. Co. Cons. mtg. 6a.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6a.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co. 1st mtg. 5a.	2,000,000	2,000,000	1900	M. & N.	100	101
St. Louis & Sub. Ry. 1st mtg. g. 5a.	2,000,000	1,400,000	1921	F. & A.	100	101
St. Louis & Sub. Ry. Income 5a.	300,000	800,000	.....	.....	60	64
Southern Electric Ry. Cons. mtg. 6a.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry. 1st mtg. g. 6a.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6a.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6a.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$400,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—May, 1898.						
California St. Cable RR. 1st mtg. g. 5a.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry. 1st mtg. 6a.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5a.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co. 1st mtg. g. 6a.	8,000,000	8,000,000	1913	J. & J.	127	129
†Metropolitan Ry. Co. 1st mtg. 5a.	200,000	.....	.....	.....	.....	.....
†Omni-bus Cable Co. 1st mtg. 5a.	2,000,000	2,000,000	1918	A. & O.	127	130
Park & Cliff House RR. 1st mtg. 6a.	350,000	350,000	1912	J. & J.	108	110
†Park & Ocean RR. 1st mtg. 6a.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry. 1st mtg. 6a.	700,000	700,000	1912	M. & S.	117	120
Sutter St. Ry. Co. 1st mtg. g. 5a.	1,000,000	900,000	1918	M. & N.	109	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—May 23, 1898.						
Belt Ry. Co. C mtg. 5a.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry. 1st mtg. 6a.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home 1st mtg. 6a.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co. Coll. tr. cons. 6a.	500,000	500,000	1901	J. & J.	117	119
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—May 23, 1898.						
Bridgeport Traction Co. 1st mtg. 5a.	2,000,000	1,688,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5a.	5,000,000	3,543,000	1931	F. & A.	110	112
†Citizens' St. R. (Ind. poll's) 1st cons. m. 5a.	4,000,000	3,000,000	1933	M. & N.	79	80
†Croftown St. Ry. (Buffalo) 1st mtg. 5a.	8,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry. 1st cons. g. 5a.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5a.	15,000,000	18,965,000	1933	J. & D.	102	103
†Croftown St. Ry. (Colu's O.) 1st mtg. g. 5a.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. g. 6a.	4,000,000	3,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'g Co. Con. m. g. 5a.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry. 1st cons. mtg. g. 5a.	6,000,000	4,931,000	1930	J. & J.	110	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5a.	5,000,000	1,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5a.	3,000,000	2,378,000	1924	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5a.	550,000	550,000	1924	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 6a.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry. Cons. mtg. g. 6a.	1,250,000	1,000,000	1931	J. & D.	107	108
†Rochester (N. Y.) Ry. 1st mtg. 5a.	8,000,000	2,000,000	1930	A. & O.	95	.....
St. Paul City Ry. Cons. g. 5a.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6a.	1,000,000	1,000,000	1900	.....	85	92
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$400,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$47,000 in treasury.						
†\$960,000 res'd to redeem prior liens.						
††\$320,000 in escrow.						
*With Int're						

*With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—May 23, 1898						
Edison Elec. Illuminating Co., Boston...	2,026,000	.....	.....	Quar.	154	.....
General Electric Co., gold coup. deb. 5a...	10,000,000	8,750,000	1922	.....	103	.....
Pittsburg, Pa.						
Date of Quotation—May 23, 1898						
Allegheny County Light Co. 1st mtg. 5a.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 4a.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6a.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(May 23, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5a.	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilg. Co. (N. Y.) con. m. g. 5a.	15,000,000	2,146,000	1933	.....	114	112
Edison Elec. Ilg. Co. (Brooklyn) 1st mtg. 5a.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 5a.	2,000,000	.....	.....	.....	103	.....
Edison Ilg. Co. (St. Louis) 1st mtg. 5a.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6a.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6a.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 5a.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—May 23, 1898.						
American Bell Telephone Co. 7a.	.....	.....	1898	F. & A.	100	.....
Northwestern Telegraph Co. 7a.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5a.	.....	.....	1911	J. & D.	108	.....
Chesapeake & Potomac Teleph. Co. 5a.	.....	.....	.....	.....	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—May 23, 1898.						
American Electric Heating Co. 5a.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 10a.	.....	.....	.....	.....	.....	25
Barney & Smith Car Co. 10a.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 5a.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5a.	75,000	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 12@12.10c.; casting, 11½c.

The Columbus (O.) Street Railway earned \$16,579 gross for the second week of May, a comparative increase of \$6,113.

The Wilmington City Electric Company, an old-established concern, and the Wilmington Light, Heat & Power Company, which was about to build a large plant in Wilmington, Del., it is reported have consolidated.

The Edison Electric Illuminating Company of New York reports for April: Gross earnings, \$260,609; operating expenses, \$139,813; net, \$120,796. The same month in 1897 the gross earnings were \$206,142; operating expenses, \$105,298; net, \$100,844.

In the action entitled The People ex rel. The Rochester Railway Company vs. the city assessors of Rochester, N. Y., Referee Benton has handed down a decision which relieves the railway company of paying any tax on its capital stock for the year 1897.

The Chicago "Dispatch" states that Charles T. Yerkes, the street railway king, has at last given his opinion as to the rate of compensation which the city should receive from the surface railway companies for fifty year franchises. He is willing, after all bills are paid, including interest charges, to divide equally with the city the profits of the companies under his control.

A meeting of the Redlands (Cal.) Electric Light & Power Company has been called to be held on July 21 for the purpose of considering and voting upon the question of increasing the capital stock of the incorporation from its present sum of \$200,000 to the sum of \$500,000, and considering and voting upon the question of increasing the present bonded indebtedness of \$100,000 to \$400,000.

The Philadelphia "Stockholder" says: "The Pennsylvania Railroad has just completed the installation of an immense storage battery to operate all the telegraph lines, telephones, call bells and other electrical appliances in use along the line between Pittsburg and Harrisburg on Sundays and at other times when the dynamo plant at Altoona is closed down. This is the most extensive application of storage battery power to such purposes undertaken up to the present time."

The suits of the Guarantee & Indemnity Company of New York, and the Guardian Investment Company of Cleveland, against the Fort Wayne Consolidated Street Railway to foreclose a mortgage for \$2,100,000 are being tried before Justice O'Rourke at Fort Wayne, Ind. J. J. Shipperd, who is accused in court of misappropriating \$300,000 worth of bonds of the company, is there as a witness.

The Consolidated Traction Company of New Jersey reports: Gross earnings for April, 1898, \$252,289.87; operating expenses, \$123,900.45; net earnings, \$128,389.42; fixed charges, interest and taxes apportioned, \$115,471.10; surplus, \$12,918.32. For the four months ending April 30, 1898, the surplus was \$16,896.82; for the corresponding period of 1897 the surplus was \$248.06.

Among the concerns in Chicago now under the control of the Chicago Edison Company are the Hyde Park Electric Light & Power Company, Hyde Park; Thomson-Houston Electric Light Company; Mutual Electric Light Company; People's Light & Power Company; People's Electric Light, Motor & Power Company; Englewood Electric Light & Power Company; Chicago Illuminating Company; Western Light & Power Company; Edgewater Electric Light Company; West Chicago Electric Light & Power Company and Enterprise Power, Light & Heat Company.

The stockholders of the Lancaster (Pa.) Electric Light, Heat & Power Company, which has a five years' contract for lighting Lancaster, recently voted to increase the capital stock from \$150,000 to \$200,000 and create a bonded indebtedness of \$100,000, the money to be used in improving the plant. On the 19th inst. a bill in equity was filed at Lancaster by John B. Oblinger, William L. Blair and Byron G. Dodge, former directors, asking the court to restrain the company's officers from making such increase. This action is construed to mean that a faction of the stockholders are opposed to any financial manipulations.

By a recent invention, carbolic, from which ethylene, said to be superior to acetylene, is generated, is being made from slag. The new utility of furnace slag is the invention of Herman L. Hartenstein of Chicago. The old Bessemer plant at Hammond, Ind., is being fitted with electrical appliances for the perfection of the venture. The process of converting the slag into a white metallic substance of twice the weight of gold is by impregnating the molten slag with pulverized coke and then subjecting the mixture to an electrical process whereby the whole is fused. It is claimed that each pound of the product will produce five feet of gas, each foot equal to fifteen of coal or water gas in illuminating power.

The Chicago "Inter Ocean" of the 18th inst. says: "The rights of the street railway controversy in Chicago are at last in a fair way to be settled. A gathering of prominent business men of the city, which met at the Grand Pacific Hotel yesterday afternoon, agreed to make an investigation into the relations of the street railway companies to the municipality and to collect such figures as are found to be necessary to show the actual state of transportation matters existing here. The work will begin at once, and the conclusions reached by the investigators will form a basis for intelligent opinion on the subject in future."

The Boston "News Bureau" states that a rumor is current that the American Bell Telephone Company is contemplating a bond issue. The company has \$2,000,000 6 per cent. debenture bonds, which mature in August, and it is possible that the company may issue new bonds to take up the maturing issue. After the recent monthly meeting a director said: "We have not yet decided whether we will pay off the bonds or exchange for new bonds. The company has plenty of money on hand, and besides has given President Hudson authority to sell by auction the 1,500 shares of stock remaining in the treasury which stockholders did not take."

Judge Wickes, at Baltimore, has ratified the sale of the Columbia & Maryland Railway Company to the Maryland Traction Company. An order was passed by the same court substituting the Maryland Traction Company for the purchasers of other franchises and property formerly owned by the Columbia & Maryland Company, including the line of railway extending from the District of Columbia northward through Hyattsville to Laurel. It is understood to be the purpose to consolidate the Eckington & Soldiers' Home Railway and the Maryland & Washington Railway in the District of Columbia with this road from the District line to Laurel, and operate them under the name of the Washington City & Suburban Railway Company. It is the intention of the Maryland Traction Company to at once complete the road between Baltimore and Ellicott City. Both the Maryland Traction Company and the Washington City & Suburban will be controlled by the stockholders of the Baltimore Security & Trading Company, but they will be operated as independent systems.

The committee on street railways have reported a bill in the Massachusetts Senate which practically revises the street railway law of the State. Among the more important provisions of the bill is one in section 7 placing an excise tax on the railways as follows: Companies whose annual gross receipts per mile of track are \$4,000 or less, 1/2 of 1 per cent. of the total annual gross receipts; companies whose gross receipts are more than \$4,000 and less than \$7,000, 1 1/2 per cent.; more than \$7,000 and less than \$14,000, 1 3/4 per cent.; more than \$14,000 and less than \$21,000, 2 per cent.; more than \$21,000 and less than \$28,000, 2 1/4 per cent.; more than \$28,000, 2 1/2 per cent. The excise tax thus provided shall be in addition to the taxes now provided by law. The eighth section permits an appeal to the Railroad Commission for a revision of the amount of the excise tax. The excise tax shall be applied towards the construction, repair, etc., of the public ways and the removal of snow therefrom. Street railway companies shall not be required to keep any portion of the surface material of the streets, roads and bridges in repair, and may, as an incident to their corporate franchise, without fee, open any street where the railway is located to make repairs or renewals of the railway.

ELECTRICITY.

Vol. XIV.

NEW YORK, JUNE 1, 1898.

No. 21.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, -- 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	321-322
A Movable Electric Bridge.	
Summer Convention of the Northwestern Electrical Association.	
Uses to Which the Telephone is Put.	
Under the Searchlight,	322
The Electrical Exhibition,	323
Convention of Fire and Police Telegraph Super- intendents,	323
Carbonization of Filaments by Electricity. By Legh S. Powell,	323
Electrical Alloys. By Hollo Appleyard,	325
The Distribution of Electrical Energy in Paris. By J. LaFargue. (Continued),	327
Electric Cables with Dry-Air Circulation. By A. Barbat,	328
On the Cathode Ray Spectrum. By M. Birke- land,	329
National Electric Light Association,	329
Rates of Fare—Train Schedule, etc.	
Reception Committee's Notice.	
Electrical Appliances in South Africa,	329
The New York Electrical Society,	330
Election of Officers—Annual Dinner.	
Canadian Notes,	330
Legal Notes,	330
The News,	330
Street Railways—Lighting Plants—Mines— Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Recent Company Elections,	331
Commercial Paragraphs,	331
Incorporations,	332
Electrical Patent Record,	332
Telephone and Telegraph,	332
Electrical Securities—Stocks, Bonds, Etc.,	333
Notes for Investors,	336

EDITORIAL NOTES.

A Movable Electric Bridge. At a recent meeting of the Channel Bridge Company, held in Paris, a rather novel method was suggested for bridging the English Channel. The new scheme consists in rolling, on a bridge submerged to a depth of 49 feet below the water surface, an immense platform emerging above the water. The latter it is proposed to operate by electricity, presumably much in the same way that a submerged tramway is now operated along a section of the British coast. The platform would be built large enough to accommodate four trains at a time, the rails on the platform being at the same elevation as the rails on land at the point of departure and arrival. Those who have studied this novel method of bridging consider it to be practicable and claim that it will do away with many of the objections raised against its predecessors as a means of opening communication between England and France. It is said to be simple and possesses absolute safety both during its execution and in its working. The present scheme is also said to escape the principal international objections raised against an overhead structure. It would moreover in no way impede or menace navigation, and the insular situation of England would still remain intact.

The platform on which the trains would stand while being electrically propelled across the Channel would be 492 feet in length and 49½ feet in width. It would be supported by iron pillars solidly braced together by means of iron girders, the whole resting on the submerged platform which would be provided with fifteen pairs of wheels rolling on rails fastened to the bridge. The submerged platform would be about one hundred feet wide, so that the columns supporting the upper platform would incline inward, thus keeping the center of gravity well over the center of the lower platform and making it impossible for the waves or wind to overturn the structure. The necessary electric current would be generated by means of a suitable electric plant on the upper platform and would be transmitted separately to each of the fifteen pairs of wheels with which the submerged platform is to be provided.

The *London Standard*, referring to this novel bridge, says:

"This new work could be completed in five years. The total cost would not exceed 350,000,000 francs, or three times less than the bridge above the water. Three rolling platforms, working simultaneously, and only during the day, would suffice for a traffic of 3,000,000 tons of merchandise and 2,000,000 passengers, which would produce an annual income of over 60,000,000 francs, or a net income of 50,000,000 francs. Considering the facility of brilliantly illumi-

nating the platforms with electricity, they could also travel at night. The great English company, the Thames Iron Works and Ship Building Company, limited, is in accord with the French *Compagnie de Fives-Lille* for the grouping around this project of the principal iron working firms and companies of the two countries into a vast international consortium, which, with the present Channel Bridge Company, will demand the concession and secure the execution of the work."

The bridging of the English Channel by a movable electric bridge, so to speak, is exceedingly interesting and rather unique, but like most gigantic undertakings it would probably be discovered after work had once begun that the original estimated cost of the undertaking was far too low. Almost insurmountable difficulties would arise and would have to be overcome, and it would therefore seem that if it is absolutely necessary that a train should make through trips from Paris to London or vice versa, some form of train float could be devised and put in operation and probably effect a saving of \$70,000,000 on the scheme suggested.

* * *

Summer Convention of the Northwestern Electrical Association.

The final arrangements for holding the summer meeting of the Northwestern Electrical Association were completed at a meeting held in Chicago on May 24 at which were present Mr. F. A. Copeland, president of the Association, the Board of Directors and the special Committee of Arrangements, consisting of Messrs. J. M. Hill, W. W. Low and Wm. Gofitz. The action taken at the meeting practically assures the success of the Convention. As we stated in a previous editorial, some weeks ago, the honorary guests are to be Mr. Thomas A. Edison, Prof. Thomson, Mr. Frank Sprague, Mr. Nikola Tesla and Mr. Wood. Prof. Elisha Gray and Mr. W. S. Mallory, we are now informed, have been added to the number.

The members attending the Convention will leave Chicago as originally planned, on the commodious steamer *Northwest* on Friday, June 10, at noon, the steamer putting in at Milwaukee for such of the members as desire to embark there instead of at Chicago. It is proposed to stop for a few hours at Mackinac Island and from there go on to Sault Ste. Marie, where the steamer is scheduled to arrive at 5 P. M. on Saturday. The vessel will first touch on the Canadian side to afford the members of the party an opportunity to inspect the plant for the smelting of nickel ores by electricity, which is very fast approaching completion and which we are informed will be in operation by the time the *Northwest* reaches there. The large plant of the *Tagona Company* and other points of interest will also be visited. The members will then be taken over to the

American side, where the citizens propose to entertain the visitors Saturday evening. The vessel will remain here until Sunday noon, which will allow of the morning being utilized for the inspection of the big locks, the ship canal and the carbide works. Hancock will be reached about 4 A. M. on Monday, and the members will be taken at an early hour to inspect the well known Calumet and Hecla copper mines, remaining until 2 P. M. While the gentlemen of the party are at these mines the ladies will be entertained by the ladies of Hancock and Houghton, the two cities being practically together.

At Duluth, where the party will arrive on Monday about 9 P. M., a large reception is to be held which should prove extremely attractive from a social standpoint. A paper on the "Electrical Smelting of Ore," is to be read at Duluth by Mr. W. T. Horry, and there is also to be a varied entertainment furnished by the citizens. Altogether the stay at Duluth should prove both enjoyable and instructive. The banquet is to be held at West Superior on Tuesday night, and will be given jointly by the citizens of Duluth and Superior. It is to be one of the most elaborate affairs ever given in the West, and will be attended by men of note from all parts of the country.

The party will leave Duluth by special train, stopping some three hours in Minneapolis for the inspection of the mammoth new power plant of the Twin City Rapid Transit Company, and will in all probability dine at the West hotel. The special train will leave Minneapolis about 8:30 P. M., arriving in Chicago early on the morning of the 16th.

As we stated in the article referred to above, a unique feature of the Convention on the steamer will be the establishment of a question-box in which questions will be dropped and answered by experts during the session. A wide range of topics of importance will be discussed, including arc lamps, lighting, meters, transformers, measuring instruments, boiler furnaces, engines, mechanical draught and numerous other topics of interest to the electrical engineer, manufacturer and central station man. Well-known experts and specialists who are prominently identified with the devices and subjects under discussion will take part, which should go far toward making the 1898 Convention an extremely valuable one from a scientific standpoint.

An unusually large attendance of central station men is assured, and we are informed that Mr. J. M. Hill, chairman of the special Committee of Arrangements, has heard from many people of note who are either owners of electrical properties or who are interested in some new electrical development, assuring him that they will be present. The technical departments of all the large manufacturing companies will, moreover, be well represented. The three days on the steamer, it is generally thought, will prove of lasting benefit. The ladies are to be unusually well provided for, but those who contemplate taking ladies would do well to address Mr. Hill, 1240 Monadnock Block, Chicago, at as early a date as possible in order that extra care may be exercised in assigning staterooms for their comfort.

It is safe to predict that this Lake Convention will prove one of the most enjoyable gatherings of the year.

* * *

Uses to Which the Telephone Is Put.

Recently a new form of telephonic apparatus has been perfected for the United States Signal Corps after five years of experimental work. This system, which somewhat resembles the Charolles system in vogue in France, might be said to be an outgrowth of the latter. The system invented by Captain Charolles of the French Army, and which bears his name, consists of an uninsulated bimetallic wire which may be laid upon the surface of the ground, each end being connected by a specially designed transmitter and receiver. The success of this appa-

ratus was to a large extent attributed by its inventor to the peculiar properties of the bimetallic wire. Experiments were made with the system in this country, and it was found that by replacing the Charolles receivers and transmitters by magneto-telephones much better results could be obtained. The experimenter, Captain James Allen of the United States Signal Corps, next made a study of the bimetallic wire, which led him to believe that equally good results could be obtained by the use of a single conductor of the same diameter as the bimetallic. Silicon, pure copper, bronze and other wires were tried with excellent results. The original idea was to use the uninsulated wire for oral communication only, but it then became necessary to adapt it to the use of the Signal Corps as a part of its means of telegraphic communication. With this end in view, Captain Allen replaced the magneto transmitter by one of carbon, with greatly improved results. The transmitters were then introduced into a circuit with a suitable battery, induction coil and telegraph key. With this arrangement the principal objection, and one that seemed almost impossible to overcome, was that the back stroke of the diaphragm was much louder than the sound obtained when the current was sent through the magnet. After considerable experimenting, however, a solution was found for this problem whereby the ordinary Morse code could be read through the receiver.

This combination of a telephone and telegraph system was thoroughly tested in actual warfare during the late trouble with the Arizona Indians. It is said to have been operated successfully in both its capacities at a distance of 625 miles. As the whole outfit weighs but about sixteen pounds it is extremely well adapted for making quick connections between neighboring army posts during a campaign.

Another important use to which a modified form of telephone has recently been adapted is in enabling deep sea divers to communicate, while under water, with their attendants. This system was invented by Captain Louis Sorocho of Baltimore, and consists of a specially designed headgear for both the diver and tender, made of rubber. This fits over the head much the same as the ordinary telephone exchange headgear. The receiver is placed over the left ear, a wooden pad over the right, which shuts out all sound and prevents pain in the ear from the air pressure. The waterproof cable containing the wires passes through the front of the diver's helmet, a stuffing-box being employed to prevent the admission of water. The necessary current for operating the phones is obtained from dry batteries, ranging in number from eight to twenty-four, according to the depth at which the diver is working. The transmitter and receiver are round and flat, much resembling those frequently met with in telephone exchanges.

By means of Captain Sorocho's submarine telephone a diver can have anything he may happen to need sent down to him, or can, if a connection is made on the surface, hold a conversation with another diver at some distance from him. As a means of safety the submarine telephone is invaluable, for should a diver's life-line become entangled or his air-pipe foul, he could notify his tender to that effect in a word and be immediately drawn to the surface. With the Sorocho apparatus, the accident which recently caused the death of a diver by asphyxiation while examining the bottom of the gunboat Newport would have been impossible.

The strength of the Spanish navy in torpedo boats makes it necessary that all the vessels of the United States navy and the forts should be provided with searchlights, but it is found to be no easy matter to purchase a sufficient quantity of searchlights in the present emergency owing to the scarcity of suitable mirrors, an adequate supply of which cannot be

had. Having the necessary reflectors, the electric companies would have no difficulty in turning out projectors at a rapid rate.

Under the Searchlight.

Notes and Comments on Various Topics.

A BOSTON financial paper publishes an item from a New York source asserting that the Manhattan Elevated Railway directors are considering plans for the equipment of the road with electricity, and that "Mr. Siemens, the foreign electrician, who some time ago made a careful inspection of the whole Manhattan system at the request of the Manhattan people, will soon arrive in this country and probably submit a plan which may be adopted. Assurances are given that Mr. Siemens' plans and ideas are the most acceptable so far investigated." It has been so often stated in the public prints that the General Electric Company had secured the electrical equipment of the Manhattan road that this announcement, which is going the rounds, comes like a surprise—that is, under ordinary circumstances, it might come in that way, but the statements set afloat by the busy press bureau of that company have so often proved false that every one has ceased to believe them. As the General Electric is using the Siemens system of underground conduit, or an imitation of it, perhaps the Manhattan directors thought it probable that Mr. Siemens might have ideas on elevated traction which it would be preferable to take from him personally rather than through the poachers who have "appropriated" his underground system.

* * *

THE Holyoke Street Railway Company is defendant in a suit for damages brought by a young woman who claims that she is entitled to \$25,000 for injuries alleged to have been received May 30, 1897, while returning from Mountain Park on one of the company's cars. The car slipped its trolley, it is claimed, and ran into a car ahead. Since the time of the accident the girl has been confined to her bed. At the trial, which is in progress as we write, one physician stated while on the stand that it was his opinion that the young woman was suffering from what might be termed "hysteria with an object," and that her recovery he believed would be very rapid after the lawsuit. It is scarcely necessary to say that he was not the physician in attendance on the girl.

* * *

New York is sending over bullish despatches on General Electric.—*Commercial Bulletin, Boston.*

THE bullish depredations of the General Electric in New York have dwindled to narrow dimensions, and the manipulators are apparently seeking other fields. It is astonishing, however, that they should have chosen Boston as a new working center. The history of General Electric is about as well known in Boston as the story of Captain Kidd, and evokes about the same kind of emotion when recalled.

* * *

A BOSTON dispatch to the New York Times, dated May 27, states that a new and powerful apparatus has just been completed by Prof. John Trowbridge of Harvard University for experiments in electrical force, his principal object being to test the penetrating power of the X-ray. The apparatus consists of a series of 120 Franklin plates or Leyden jars, supplied with power by a storage battery containing 10,000 Planté cells. The voltage necessary for experiments is 2,500,000. Prof. Trowbridge already has made experiments which prove that with apparatus as powerful as this the X-rays can be made to penetrate not only human flesh, but also bones and tendons, thus probably making possible still more remarkable attainments in surgery by their aid.

THE ELECTRICAL EXHIBITION.

The management of the Exhibition has decided to keep this instructive and most entertaining show open a few days longer than was originally intended, and have therefore leased the Garden until Saturday, June 4. This will afford many persons, who probably otherwise would have missed seeing the many electrical wonders, an opportunity of examining them. In spite of the inclement weather which New York had been experiencing almost unceasingly for the past week, throngs continued to congregate in the Garden and take the most lively interest in all the special features and many of the private exhibits. The school children, who took the Garden by storm some ten days ago, continue to besiege it every afternoon in throngs. To these children the phonographs, electric cascade, submarine mines and bright lights make the place a fairyland. The lighting of the tower on the Garden attracts general attention and may be seen for miles around. The striking and original effect produced by multi-colored beams from fourteen searchlights behind a mass of very thin white silk gauze is beyond description. The *Evening Post* describes the effect as follows:

"The tower of Madison Square Garden has often presented a beautiful spectacle at night, but it was never more a vision of beauty than since the Electrical Exhibition opened. With apparatus and by means which the management refuses to disclose, the tower each evening after dark is thrown up against the sky with a multi-colored radiance that causes every eye to be turned upon it, not only in the adjacent streets, but across the ferries and out well into New Jersey, and the Connecticut suburbs. The name that is already commonly given to this popular performance is 'Diana's skirt dance.' It really seems to be a huge representation of the Loie Fuller effects, with the aid of the wind and of colored screens and searchlights. In waving columns of steam and cloud, some diaphanous material coils and curves around the shaft of the tower, right up to the foot of Diana, and then the tinted fires of electricity are let loose on this ever-changing scenic effect. At one minute the tower is all the colors of the rainbow; the next it is a pearly white or blue, and then again it is all bathed in blood red, while at the same time a keen searchlight is thrown on Diana herself, as she points to the wind. Just below, of course, hangs the electric sign of the show, suggesting the wondrous things that are going on within the Garden itself; and thus a piece of advertising not less beautiful than it is clever accomplishes its purpose."

The special exhibits continue to attract general attention. One of the most instructive is that of the underground trolley. The track is of standard gauge and is made up of two rails 9 inches high weighing 90 pounds to the yard. Full size yokes are shown which carry conduits consisting of 6-inch ducts imbedded in concrete. A full size car is operated backward and forward over the section, which is some 60 feet in length.

Another exhibit which has been attracting considerable attention is that of Prof. S. H. Short, which consists of a pioneer electric car used in Denver, Col., as far back as 1885. This car is shown running on underground conductors and was one of the first attempts at underground propulsion.

The Diesel motor, located in the basement, is attracting the attention of central station men from all over the country. The motor which is now being exhibited is of 20 horse-power, directly coupled to a generator. It runs at the comparatively low speed of 170 revolutions per minute, as owing to its late arrival time was lacking to adjust it to a higher speed suitable for electrical work.

The Exhibition has unquestionably been well managed and care and judgment exercised in the selection of the special features. It only remains now for the gentlemen who have devoted both their

time and energy to afford the public an opportunity of visiting an unsurpassed electrical show, to reap the reward of their labor.

Convention of Fire and Police Telegraph Superintendents.

[OFFICIAL.]

Brooklyn, N. Y., June 1, 1898.

To Superintendents and Electricians:

The Third Annual Convention of the Fire and Police Telegraph Superintendents and Municipal Electricians will be held at Elmira, N. Y., August 9 and 10, 1898, at 10 A. M. All members are expected to be present. Bring your ladies; special arrangements are being made for their entertainment. Several papers will be read by well-known electricians. Will you be present? Fraternally.

W. Y. ELLETT, President,
Elmira, N. Y.

H. F. BLACKWELL, Secretary.

Take D. L. & W. Road from New York or Buffalo and intermediate points.

Electrical Work in South Africa.

The *British and South African Export Gazette* gives many items of news which show that the advantages of electric transmission of power are bringing it to the fore. Thus we learn that "a power plant has just been installed at the York gold mine, comprising two belt-driven 50-H.P. three-phase inductor type generators, running at 750 revolutions per minute and supplying power to two 24-H.P. motors coupled to belt-driven pumps; also a 3-H.P. motor connected to a centrifugal pump; and several small motors for various kinds of machinery, including one of 9-H.P., coupled direct to a continuous current dynamo of 15 volts 300 amperes output, for cyanide work." Again, "an electrical plant recently sent out to the Vogelstruis gold mine by the General Electric Company, Manchester, consisted of two 150-KW. three-phase generators, belt-driven at a speed of 300 revolutions per minute, a frequency of 30 cycles and a pressure of 950 volts; three triplex single-acting pumps, with plungers $6\frac{1}{2}$ in. by 8 in., coupled direct to 35-H.P. motors running at 360 revolutions.

"Speaking of the increasing difficulty which the South African mining industry, and in particular that of the Rand, has experienced in procuring a sufficient supply of native labor, this fact has given a great stimulus to the introduction of machine drills. A variety of these have been imported, chiefly from America, or invented to meet the requirements of the mining industry, and have been largely adopted by mining companies. Opinions, however, differ as to the economy of their employment as compared with hand labor, although it is admitted that they have the advantage of placing the mines in a position of independence with regard to hand labor in cases of emergency, and often do away with the necessity of stopping driving power.

"The drills in use have been found to work well in large stopes, but less so in small. The chief desiderata of a good stopping drill are considered to be (1) lightness, so as to be easily handled; (2) strength, so as to reduce repairs to a minimum; and (3) economy in air (or other power) consumption. The drills known on the Rand are driven by air and steam, but the latter has been found very objectionable in working. No electric drill has, however, yet been placed on the market so far as we are aware. This affords an opening for English electrical invention which it is to be hoped may be taken advantage of for the credit and profit of home industries, as the market for this class of tool in South Africa is undoubtedly large and growing."—*Elec. Engineer, London.*

The General Electric Company owed on January 1, 1898, \$1,339,360 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

CARBONIZATION OF FILAMENTS BY ELECTRICITY.*

BY LEIGH S. POWELL.

The idea of carbonizing filaments by electricity, in lieu of the common furnace method, must have occurred to many. It was widely reported some ten or twelve years ago that the remarkable "adamant" filaments, introduced by Woodhouse and Rawson, had been subjected to intense heat by electricity, but no details of the process employed were ever noised about or reached the ears of the writer; and it is believed that at the present time the carbonization of filaments by means of electricity has not been practically adopted. As the subject is not without interest or economic possibilities, it has occurred to the writer to be worth while putting on record an electric method he devised for this purpose about five years ago, and a few particulars of certain rough and superficial experiments which were made at the time at a Continental lamp factory to test its practicability. It is hoped that some incandescent lamp experts, who care to test the plan further, and who are able to bring together the means and conditions needed for the investigation, will succeed in bringing this process, or one allied to it, to a successful issue.

The features of the method in question and the principles involved are very simple and obvious. The carbon blocks on which the cellulose threads are wound are conductors of electricity, and the plumbago powder in which they are packed is likewise a conductor. If a pile of blocks be therefore made with a layer of plumbago powder between each, and the whole be surrounded with suitable non-heat and electricity-conducting materials, while a current of electricity is made to pass, it is evident that the blocks will become heated, and grow hotter and hotter, until in time the filaments will be carbonized or "baked."

To bake filaments successfully by this method, it is naturally necessary to attend to several conditions. It is obviously of prime importance that the heterogeneous conductor be encased in insulating material of the best quality, and arranged in the most suitable manner. It is equally necessary to exclude the air, so as to prevent the burning of the filaments. Other considerations of more or less importance are: facility in packing and unpacking the containing vessel, the construction of the terminal conductors, the manner of applying the current, the duration of the operation, and the final cooling of the blocks.

As already intimated, the experiments that were made were in the nature of mere trials rather than a serious and persistent attempt to thoroughly ascertain the economic practicability of the method. Two experiments only were made; and as the notes taken of the dimensions, times, amperes, etc., were far from complete, and also by reason of the superficial nature of the trials, it is not proposed to describe them in detail. Suffice it to say that in the first experiment two parallel brick troughs were constructed on a brick platform covered with a layer of slag wool. The troughs, which were about a meter long, were packed with wound blocks, plumbago powder being sprinkled between each space. The current entered one trough by means of a stout terminal plate of carbon, flowed to the end, then across to the other trough by a long slab of carbon, and so on to the other terminal. The upper surface of the troughs was covered by slabs of earthenware, and the whole was surrounded with a thick coat of slag wool.

The current which was available for the operation had a pressure of 110 volts, and this factor was largely responsible for the arrangement of the furnace in manner described. The resistance could was a little over 2 ohms, and the current at the start was 50 amperes. In an hour or so the current had risen to 150 amperes, when it was lowered to 50 amperes again by introducing an external resistance. At the re-

*From the *Electrical Review*, London.

duced pressure the resistance of the circuit continued to decrease, and the current once more rose to 150 amperes.

On examining the filaments at the end of the operation they were found to be brittle and useless, a circumstance which was probably due to burning by access of air during cooling, to hasten which a considerable quantity of slag wool had been removed.

In the second experiment the length of the row of blocks was increased to about three meters in order more nearly to suit the current pressure; and instead of forming a simple \cup the course ran thus $\cup \cup \cup$. To more effectually displace the air, a layer of plumbago powder, sprinkled with paraffin, was spread along the bottom of the troughs before charging them with the blocks. In this experiment the plumbago powder was more tightly compressed than in the previous one, the resistance cold being 8.8 ohms. For the purpose of raising the temperature more slowly at the commencement, an external resistance was included in the circuit, and the current adjusted to about 18 or 19 amperes. Instead of the resistance falling from the start, as in the previous experiment, it had a tendency to rise during about 5 hours. This increase, which amounted at the maximum point to about 25 per cent, may possibly have been due to the presence of paraffin. By gradually cutting out the resistance, the current was caused to rise slowly to 25 amperes. In 10 hours from the start the current was only 30 amperes, in 12 hours it was 35 amperes, in 14 hours 55 amperes, and in 17 hours it had reached 65 amperes. The circuit was here interrupted for the night, but was again closed next day, after a lapse of 6½ hours, the current starting at 27 amperes. In 6 hours' time it once more attained 65 amperes. It is believed that the current was stopped soon after this, but the notes taken are not specific on the point.

The majority of the filaments obtained from this second operation were satisfactory in every respect, their flexibility and "color" being good, while their resistance cold remained practically steady both before and after raising to incandescence in an inert gas.

The problem of baking filaments by electricity was allowed to drop, not because it was anticipated that the process could not be made to give satisfactory results, but principally because it was not considered to be worth while to arrange for a current of lower pressure and larger quantity to suit other and more convenient forms of apparatus, and also because it was supposed, by some, that the electric method would not prove to be more economical, or possess any striking advantage over the ordinary furnace plan. Without, however, ascertaining a good deal more thoroughly what degree of perfection can be attained, the data wherewith to form a sound judgment as to cost, etc., are not forthcoming.

To describe in detail the best manner of proceeding in order to construct suitable and efficient apparatus is not in the writer's power. Many materials and arrangements, however, naturally suggest themselves, and some of the more prominent of these may, perhaps, be mentioned.

It is patent that, in order to reduce the cost of the predominating item of expense, viz., current, to a minimum, it is imperative that the amount of matter surrounding the blocks, consistent, of course, with good heat insulation, should be reduced to utmost limit. In the experiments referred to, this condition was most imperfectly studied. A considerable mass of brickwork became heated to bright redness, at the expense of current, by contact with the blocks, and the extensive external brick surface was moreover very inadequately protected by the slag wool from the cooling influence of the surrounding air. The vessel in which the blocks are packed should, by preference, be either cylindrical or rec-

tangular in form—the latter to suit the shape of the blocks—and of large enough dimensions, both in height and diameter, to be convenient for packing and unpacking the blocks. The vessel should stand in an upright position, and it should be made as thin in the wall as possible of a material which is practically impervious to air. Probably as good a material to use for the purpose as any would be the fire-clay employed for making salamander crucibles. The vessels should be closed both at the top and bottom by a stout carbon plate or disk, the bottom one being cemented into position so as to admit no air at the junction with the vessel. The platform on which the vessel rests might, perhaps, best be made of the porous fire-clay of which Fletcher's furnaces are made.

The question of how best to prevent the escape of heat at high temperatures is doubtless one in which a good deal of improvement might be made on attainments already arrived at, and it would form an interesting subject for investigation. Without possessing any special experience on the subject, the writer would propose that the vessel should be surrounded by two, three, or more (as may be found desirable) movable cylindrical covers of increasing dimensions, and made of the same material as the platform. Each cover, which must perforce have a small hole at the top through which the conductor, conveying the current, must pass, should be made as thin as practicable. The lower rims of the covers might fit into concentric grooves made in the platform, each groove being filled with powdered charcoal or lampblack. A series of air spaces would thus surround the vessel at regular intervals, and these would be likely to effect good heat insulation, while the actual mass of solid material employed would be reduced to a comparatively small cubical bulk. The arrangement would further possess the advantage of easily and expeditiously effecting the cooling of the blocks at the close of an operation by the simple removal of the covers or shades.

It may well be that better heat insulation and more conveniently arranged apparatus might be constructed on other lines. Many insulating materials packed round the vessel, such as asbestos, slag wool, lampblack, metallic oxides, etc., might perhaps be arranged to give excellent results. In the selection of such substances, it would be well to bear in mind the different specific heats which the various substances possess, although other properties and considerations may very likely far outweigh this one in importance.

All the world knows of the remarkable success which has attended Prof. Dewar in his experiments on liquid air and its preservation by means of exceptionally perfect heat insulation, effected by surrounding it with an intervening vacuum. The application of this principle to the form of electric furnace under discussion would doubtless be productive of highly successful results. The manner of constructing apparatus involving this principle is, however, not so very apparent, although it is a problem which would be well worth attempting.

Another principle, which might be made to give satisfactory results, would be that of heating the outside of the vessel by means of gas or otherwise, and so lessen the escape of heat generated by electricity. A loose outside fire-clay mantle might be arranged round the vessel, inside which gas was made to burn, or heated gases to circulate. The external surface of the case would not need such careful protection from the outside air, and the cooling down at the end of the operation could be easily effected. The total energy expended by this means of conservation of temperature would naturally be greater, but not necessarily more costly by reason of the difference in cost of heat produced by gas and that produced by electricity.

As regards the current needed for the generation of heat, it would doubtless be necessary to have the power of considerable variation of electromotive

force. The amount of energy consumed would depend almost entirely upon the perfection of the surrounding heat insulation. With this very perfect, and with sufficient time, the temperature requisite for the proper carbonization of filaments should be reached with a comparatively small current. The manner in which the current is applied and the duration of the operation to give the best results are points which can only be determined by actual experience with any particular form of apparatus.

It may, perhaps, be idle to let the imagination run too freely on the advantages that are likely to result from the carbonization of filaments by electrical means over methods of heating by fuel, before they have been actually demonstrated. Some advantages, however, are highly probable, and a few of them may be enumerated:

1. The wear and tear of the apparatus is likely to be appreciably less for the following reasons: (a) There would be more regular heating and cooling of the apparatus; (b) there would be less lifting and moving about of the apparatus both in the heated and cold condition; (c) there would be an absence of fluxing material to destroy the apparatus.

2. The precision with which the current could be regulated ought to ensure greater uniformity in the quality and resistances of the several batches of filaments turned out in the regular course of manufacture. The defect inherent in the use of crucibles heated from an external source, due to the impossibility of heating equally all parts of the contents whilst raising the temperature, would be wholly absent.

3. The labor needed to work the process would be of a much more agreeable and less arduous description.

In addition to these probable advantages, it is quite possible that the electric method might possess others of an important nature. The temperature of the furnace might be easily raised to a very high degree, and this condition might be conducive to producing filaments of a very dense and durable description. Further, by reason of the compact and isolated manner in which the apparatus might be arranged, it would be possible to perform the carbonization under unusual physical and chemical conditions, such as in vacuum or under pressure in air or hydro-carbons or other gases by inclosing it in a suitable chamber. Such altered conditions might result in producing new and desirable results.

On the question of initial cost of apparatus and of the electric energy consumed, it will be prudent to venture no remark other than that both are likely to be in favor of electricity as compared with heating by fuel.

The electric furnace in various forms is now being employed in a number of industrial manufactures, both in the smelting of metals and in the preparation of substances such as carbide of calcium, graphite for electrodes, carborundum, etc., and there seems no reason why it should not be also successfully applied to the carbonization of filaments.

International Exhibition at Glasgow.

There is to be held in Glasgow, Scotland, in 1901 an International Exhibition at which special attention to electricity will be given, both for lighting and power services. The guarantee fund for the Exhibition already exceeds \$1,750,000.

The railway committee of the Privy Council at Ottawa has granted a charter to the North Shore Electric Railway Company which proposes to build a railway in the vicinity of Montreal connecting Montreal with outlying districts. This road will run from Three Rivers, Que., along the north shore of the St. Lawrence. The promoters of this enterprise intend to use the water power of Shawanigan Falls for the generation of the necessary power to operate the road.

ELECTRICAL ALLOYS.*

BY ROLLO APPELYARD

Ten years ago German metallurgists began to study the problem of mechanical and electrical permanence of the cheaper alloys used for resistance coils. They appealed to the Reichsanstalt. Metal founders submitted specimens for analysis and criticism, elaborate tests were made, and the results led to the favor and adoption of "manganin" and "constantan." There is still some doubt as to the durability of these alloys, but the evidence shows that, with proper precautions, manganin and constantan may be protected against all ordinary sources of deterioration. The history of that investigation deserves to be told in full, as an object-lesson upon the benefits conferred by a National Laboratory. It is all written in Band II of the *Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt*; parts of it have from time to time been quoted in various electrical journals, but several important details have been omitted; it is therefore proposed here to give a summary of the investigation more or less as it appears in the original volume.

I. METALLIC ALLOYS FOR STANDARD RESISTANCES.

The first step was to investigate the electrical resistance of most of the familiar alloys, with the intention of elucidating the question of the variation of their specific resistances, for it is these variations that most disturb precise measurements. German-silver was next examined, samples being taken from that made by Messrs. Siemens & Halske for standard resistances; also nickel wire from Obermaier, of Nürnberg, and platinum-silver and platinum-iridium from Messrs. Herius, of Hanau. Of these alloys, the particular quality of platinum-silver examined was found to be too inhomogeneous and too brittle; it had, therefore, to be excluded from the final research.

Platinum-iridium, on account of its high price and great temperature coefficient, was discarded, as it was considered to be only of secondary importance for practical purposes. In the course of the experiments, the nickel used for coins in the Imperial Mint and manufactured by Messrs. Basse and Selve in Altena, under the trade name of "Patent nickel," was carefully tested.

In order to characterize the materials as nearly as possible, analyses of the various samples were made in the Chemical Laboratory of the Reichsanstalt, with the following results:

TABLE I.

	German silver (1 mm.) Messrs. Siemens and Halske.	Nickel. (1 mm.) Messrs. Obermaier.	Patent nickel.
Copper ...	90.16	61.63	74.71
Zinc ...	25.37	19.67	0.52
Nickel ...	14.03	18.46	24.14
Cobalt ...	Trace	0.19	Trace.
Iron ...	0.30	0.24	0.70
Manganese ...	Trace	0.18	0.17
Tin ...	...	...	Trace.
Sp. resistance ...	30.0	33.2	32.8
Temp. coefficient	0.00036	0.00030	0.00021
Thermo-electric power against Cu.	14.4	18.1	29.1

For reference, three physical constants are added to the table: (1) The specific resistance in microhm-centimeters; (2) the thermo-electric power against copper in micro-volts per 1° C., temperature difference; and (3) the temperature coefficient.

In the next case, the effect of rolling the wire was investigated at various adjustments of the rollers. Copper pieces were hard soldered to the ends of the wire under test, and the resistance was measured; then, avoiding tensile strain so far as possible, the wire was rolled, and finally its resistance was again determined at the same temperature.

All wires in Table II show an increase of resist-

ance after rolling, varying from 0.04 per cent. to about 0.87 per cent. Patent nickel varies least, german-silver the most. If the diameter of the roller is 40 times that of the wire, only a very small increase in the resistance of the patent nickel wire is observed; with german-silver the increase is about four times greater. If rollers of ten times the diameter of the wire are used, both of these alloys show a change of resistance of about four times the above increment. The cause of this increase of resistance by rolling is partly due to stretch, and partly to mechanical hardening, the result of bending and twisting.

Variations due to bending may be prevented very easily and effectively in standard resistances, by attaching the wires permanently to metal with a strong coating of shellac.

The quasi-permanent resistance changes due to heating of the material are much more serious. In order to investigate them, bobbins of the foregoing metals were heated for several hours in a dry oven at 40° C., 100° C., and 150° C., and then again at 100° C., measuring the resistance before and after every heating. Table III, column 6, shows the

TABLE II.

Specimen of wire.	Diameter of rollers.	Resistance in ohms.		Increase per cent.
		Before rolling.	After rolling.	
1. Standard German silver (Siemens and Halske) 1 mm.	20 mm.	2.2403	2.2875	0.77
	10 "	2.2460	2.2594	0.60
	10 "	2.2470	2.2666	0.87
	40 "	2.2425	2.2457	0.14
	40 "	2.2469	2.2561	0.41
2. Nickelin (Obermaier) 1 "	40 "	2.2440	2.2500	0.27
	10 "	1.9603	1.9698	0.48
	10 "	1.9977	2.0000	0.12
	10 "	2.0008	2.0024	0.08
	3 "	2.0099	2.0198	0.49
3. Platinum-silver (Herius) ... 0.3 "	4 "	2.0205	2.0217	0.06
4. Platinum-iridium ... 0.3 "	3 "	2.01405	2.0190	0.25
5. Patent nickel ... 1 "	40 "	2.8687	2.8704	0.06
" ... 0.6 "	10 "	1.1031	1.0035	0.04
" ... 0.6 "	24 "	6.0106	6.0149	0.07
" ... 0.6 "	6 "	2.9946	3.0034	0.23
" ... 0.3 "	12 "	15.1748	15.0837	0.06
" ... 0.3 "	3 "	5.0583	5.0973	0.77

TABLE III.

Specimen of wire.	Duration.	Temperature.	Resistance before and after the heating.		Variation.
			Before heating.	After heating.	
1	2	3	4	5	6
1. German silver (Siemens and Halske). 1 mm.	Hours.	Degs. C.	Ohms.	Ohms.	Per cent.
	7	40	1.9698	1.9706	+0.04
	3	150	1.9706	1.9875	+0.85
	5	100	1.9875	1.9878	+0.02
	7	40	2.0000	2.0007	+0.04
2. Nickelin (Obermaier). 1 mm.	3	150	2.0007	2.0146	+0.69
	5	100	2.0146	2.0147	+0.01
	8	140	2.8704	2.8692	-0.04
	2	150	2.8692	2.8575	-0.41
	8	100	2.8575	2.8578	+0.00
3. Patent nickel. 1 mm.	8	100	2.8578	2.8577	-0.00
	5	100	6.0149	6.0056	-0.15
	4	100	6.0056	6.0048	-0.01
	2	150	6.0048	5.9962	-0.14
	3	100	5.9962	5.9963	+0.00
4. Patent nickel. 0.6 mm.	14 days. Room temperature.		5.9963	5.9964	+0.00
	8	40	15.0837	15.0779	-0.04
	2	150	15.0779	15.0067	-0.47
	3	100	15.0067	15.0071	+0.00
	6	40	6.0370	5.9945	-0.05
5. Patent nickel. 0.3 mm.	3	100	6.0946	6.0863	-0.16
	2	150	6.0863	6.0726	-0.27
	2	100	6.0726	6.0726	0

alteration of resistance, corresponding to the various temperature ranges. Patent nickel gives a diminution, german-silver and nickelin an increase, of the specific resistance after heating. The first heating, 40° C., produces a slight but definite alteration with all the wires. With the next heatings, 100° C. and 150° C., german-silver and nickelin have very nearly the same order of increase, which is approximately double of the diminution exhibited by patent nickel. Heating at 100° C., after previous long-continued heating at 150° C., influences german-silver and nickelin only very slightly; with patent nickel, as a general rule, there is no difference within the limits of observation. The important results derived from these experiments are: (1) that the specific resistance of german-silver and nickelin can be made approximately constant by

prolonged heating at 150° C.; and (2) that the specific resistance of patent nickel becomes, within the limits of observation, perfectly constant under the same treatment, so that it does not undergo any subsequent changes even when heated to 100° C. Secondly, the experiments show that of the materials investigated patent nickel is essentially better than german-silver and nickelin as a material for standard resistances. The above variations are considered by the Reichsanstalt to be due to the presence of zinc in the german-silver and in the nickelin samples.

Resistance Alterations Due to Other Influences.—Of the other influences that can bring about variations in the resistance of metallic alloys, oxidation has first to be considered. The results show that shellac is effective in preventing oxidation, even with the alloys most liable to be attacked. The thermo-electric force of the above specimens against copper brings about apparent changes of resistance. These changes are most observable with low resistances used with large currents; but by suitably designing the resistances and apparatus they can be nullified.

Of much more importance are the changes of specific resistance with temperature. There is no means for compensating these changes, they can only be held within limits by careful jacketing in oil baths, meanwhile observing the temperature of the oil. They constitute the principal cause of uncertainty in standard resistance coils, and they form the starting point of the investigations of the Reichsanstalt.

Klemencic studied the properties of platinum-iridium and several other alloys used as standards of electrical resistance. He investigated platinum-iridium, platinum-silver, german-silver and nickelin, but without giving analyses of the samples. The Reichsanstalt have since examined some of the nickelin alloys used by him, and they find their composition to be:

	Copper.	Nickel.	Manganese.
1. Bare wire.....	75.4	24.6	Trace.
2. Covered wire....	75.5	24.5	Trace.

thus corresponding with the patent nickel in Table I.

The different materials were tested with regard to their specific resistance, their temperature coefficients, and their thermo-electric force against copper, also the change of their resistance with time, the influences of mechanical deformation and of moderate temperatures. As a result of the whole investigation, it is found that german-silver is of all the alloys the least suitable material for standards of resistance, since it is the one most influenced by mechanical deformations. In this regard the Reichsanstalt conclusions agree with those of Klemencic. The temperature changes in Klemencic's experiments, though comparatively small, were quite great enough to produce noticeable acceleration of the resistance variations. He himself says: "It would perhaps be possible to bring newly-constructed resistance coils to a final steady value by submitting them for a considerable time to a fairly high temperature." But he did not pursue this idea very far. In his investigations, platinum-silver, such as was recommended thirty years before by Matthiessen, proved the best; in the Reichsanstalt experiments, however, this material seemed to lack homogeneity. With regard to the use of "nickelin" (patent nickel) of standard resistances, Klemencic says: "It has many good properties, but its high thermo-electric power against copper, and the small degree to which it can withstand chemical actions, must be regarded as unfavorable." This alloy is very generally used in the construction of coils for ordinary resistance boxes.

II.—NEW ALLOYS.

It was thought that some further diminution in temperature coefficients could be obtained, for it was found that with some specimens of patent nickel examined at the Reichsanstalt this constant had fallen to 0.00017. It appeared that this diminution resulted from increase of nickel in the constitution

* From the *Electrical Review*, London.

of the alloy. A number of experiments were therefore made with copper and nickel, or similar metals, in order to investigate the effect of the quantity of nickel upon the temperature coefficients. Alloys of copper and manganese, such as were being made by Dillenburg at the Isabell foundry for parts of machinery, were examined. The Reichsanstalt were encouraged to pursue this investigation by the success of the patent alloys of Weston, of Newark, N. J. (American patents Nos. 381,304 and 381,305), which

and 3. Abscissæ in Fig. 2 represent different alloys of nickel; the ordinates marked ρ represent the specific resistance in microhms per co.; those marked α represent the temperature coefficients, giving the significant figures after four decimal places. The ordinates drawn to meet the curves represent the observed values. Fig. 3 sets forth the same data for manganese alloys. Fig. 4 shows the variation of resistance with temperature for various alloys of manganese and copper. These alloys can only be ex-

manganese produces an alloy which at 0° C. has a small positive temperature coefficient; this vanishes at from 40° C. to 50° C., and beyond that temperature assumes increasing negative values. In Fig. 4 the ordinates of the seven curves show these various results, each represents the change in resistance experienced by a wire of 1 ohm when its temperature is varied from 0° C. to 100° C.

With nickel-copper the diminution of temperature coefficients as the nickel is added is slower than the

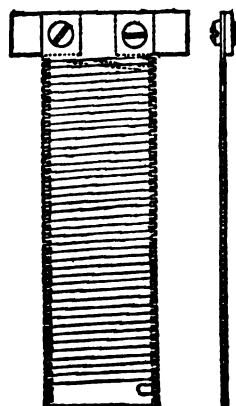


FIG. 1.

Variation of the resistance of alloys of manganese and copper with temperature.

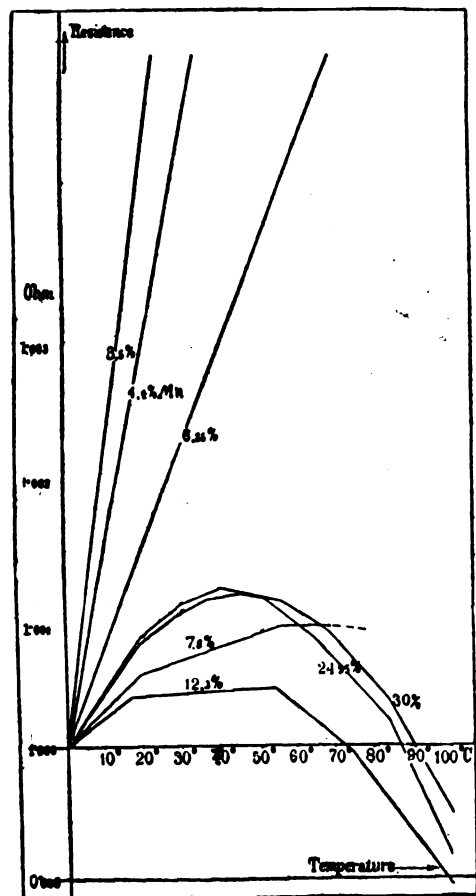


FIG. 4.

were described as having negative temperature coefficients. Twelve nickel-copper alloys, with different quantities of nickel, were therefore specially manufactured for them by Basse and Selve, in Altena, Westphalia. The specific resistances and temperature coefficients were determined from wires of 0.5 mm. diameter and about 2 mm. long, soldered to copper contact pieces, and after their diameter and length had been measured, wound double upon a strip of mica, as represented in Fig. 1. Afterwards these wires were kept in a thermostat at 120° C. in a dry heat for 24 hours. The wire was then put into an oil bath, and its resistance was measured at different temperatures. The results corresponding to both groups of alloys are given in curves in Figs. 2

and 3. Abscissæ in Fig. 2 represent different alloys of nickel; the ordinates marked ρ represent the specific resistance in microhms per co.; those marked α represent the temperature coefficients, giving the significant figures after four decimal places. The ordinates drawn to meet the curves represent the observed values. Fig. 3 sets forth the same data for manganese alloys. Fig. 4 shows the variation of resistance with temperature for various alloys of manganese and copper. These alloys can only be ex-

amined up to 30 per cent. of manganese, as alloys beyond that limit cannot be worked. Both with copper-manganese and copper-nickel alloys, the specific resistance increases in proportion to the added manganese or nickel; up to this 30 per cent. value, the resistance of copper-manganese increases about 2.5 times as rapidly as copper-nickel. With the latter alloy, the resistance then diminishes up to 46 per cent. of nickel, and then remains fairly constant up to 62 per cent.; after that, it falls steadily until the metal is all nickel.

With manganese-copper, the temperature coefficient diminishes at first very rapidly, then gradually slower, until at 7 per cent. of manganese it becomes nil. Beyond that point, increasing the quantity of

Temperature coefficient α , specific resistance ρ and thermo-electric force (against copper) \mathcal{E} the constitution of the alloy of nickel and copper.

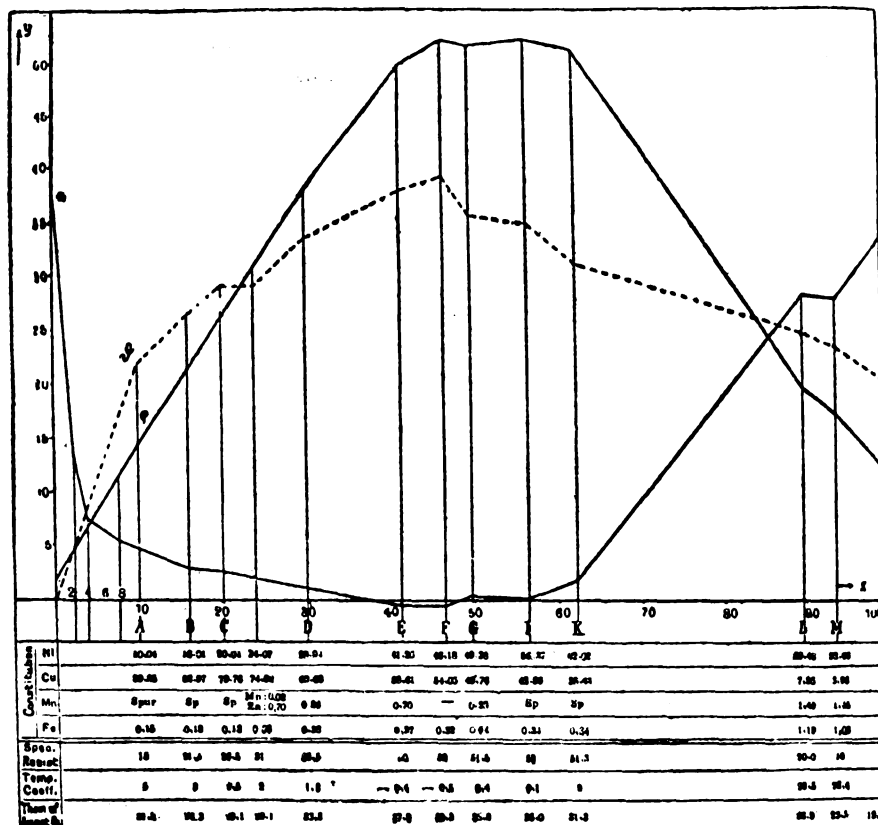


FIG. 2.

Variation of manganese with temperature.

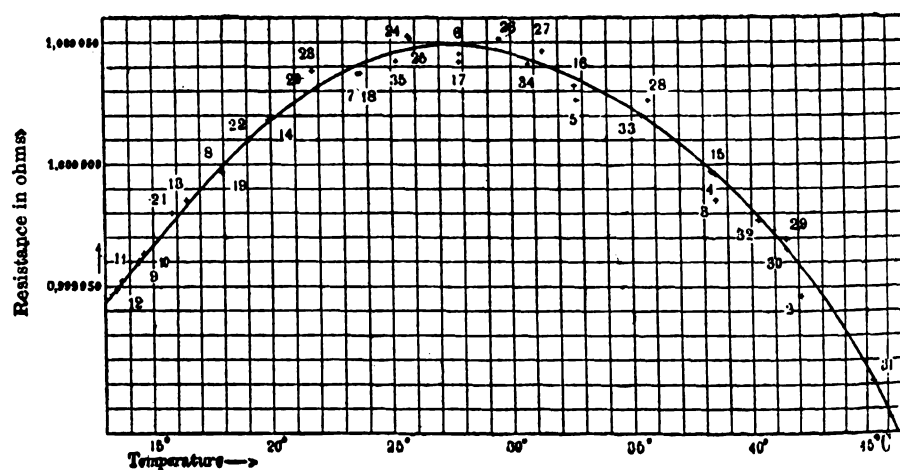


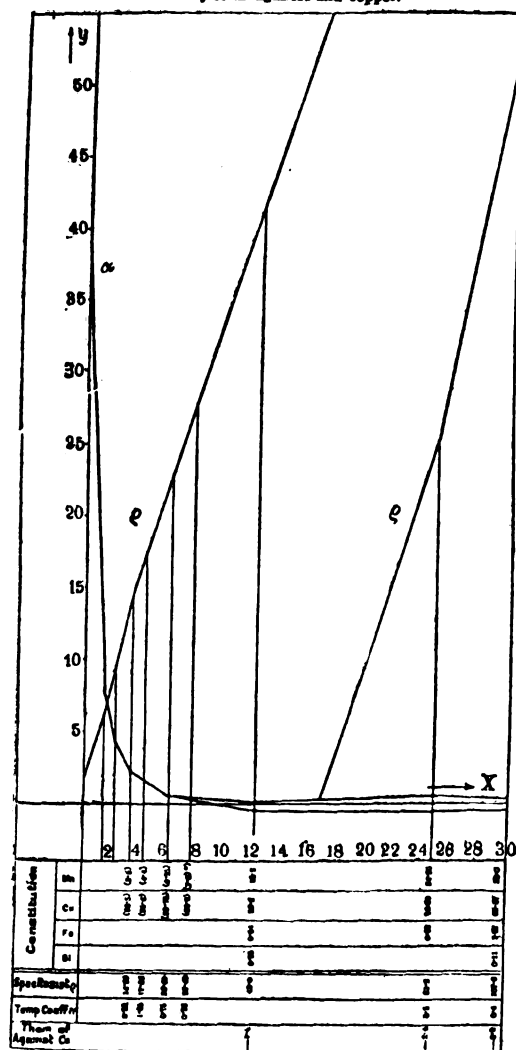
FIG. 5.

change noticed when manganese is added to manganese-copper; it is slower in the same proportion as the increase of specific resistance is less. Close to the zero-line there is a bend to the curve of alteration of temperature coefficients, the second part of the curve is not horizontal, but has a slight upward inclination, and then falls somewhat rapidly towards the zero line at 46 per cent. of nickel. This alloy gives the least temperature coefficient. At this same 46 per cent. value the specific resistance also attains its maximum.

The alloy represented by F (Fig. 2) has approximately the chemical formula NiCu. In these alloys it may be supposed that the combination of one molecule of nickel with one of copper is mixed with

different quantities of copper and nickel, and that these possess high specific resistances and negative temperature coefficients. The practical result of this investigation is to show that it is possible to obtain two kinds of alloys with vanishing temperature coefficients. With manganese-copper only 7 per cent. of manganese is required to produce an alloy of infinitesimal temperature coefficient. In practice, 12 parts by weight of manganese, 2 of nickel and 86 of copper are adopted. Nickel has the effect of raising the thermo-electric force against copper, besides delaying the bend of the curve of resistance variation with temperature by about 20° C. (see Fig. 4). This alloy has received the name of manganin. It is specially made at the Isabell foundry for standard resistance coils. Fig. 5 shows the change in resistance of a 1-ohm coil of manganin at various temperatures; the observation-points on the curve are numbered for purposes of reference.

Temperature coefficient α , specific resistance ρ the constitution of the alloy of manganese and copper.



The numbers in brackets are interpolated from the specific resistances of the specimens as observed.

Fig. 3.

From the curve given in Fig. 3 it appears that there are only two alloys of nickel and copper for which the temperature coefficient vanishes. The relative merits of these two alloys remain to be studied. Messrs. Baase & Selve, of Altena, who have made all the sample alloys for the Reichsanstalt throughout this investigation, make an alloy with 40 per cent. of nickel, corresponding to the first coincidence of the curve with the abscissa axis, and they have given this alloy the trade name of "constantan."

Important as is the production of an alloy possessed of a vanishing temperature coefficient, such an alloy cannot be adopted for standard coils until the permanence of the specific resistance has been firmly established. Experiment seems to have proved that manganin and constantan are, in this regard, as

suitable as patent nickel. In considering other properties, the thermo-electric power against copper comes first under notice. The table given below, Fig. 3, shows that manganese-copper has only small negative values for this power; this can be got rid of altogether by adding a trace of nickel to the alloy. On the other hand, nickel-copper, and especially constantan, have high thermo-electric power against copper; these are given in microvolts in Fig. 2 for different proportions of nickel.

The recorded values were determined by soldering the ends of the specimen wires to copper wires that were connected to a galvanometer. All the wires were contained in an oil bath kept at constant temperature by a heating spiral and a stirring wheel. The thermo-electric power disturbed the resistance measurements, especially when low resistances and strong currents were employed. It is true that these defects can generally be eliminated by care in the construction of the apparatus, but for resistance measurements of great precision it is almost essential to have a material such as manganin, for which the thermo-electric power against copper is nil.

Manganin is rather easily oxidized; this, no doubt, is due to the affinity between the manganese and the oxygen of the air. At 100° C. the wire soon tarnishes, and during annealing the surface manganese is perceptibly oxidized out of the alloy, leaving a surface of copper beneath the oxide. As might be expected, the electrical qualities suffer in consequence. The surface of copper can be removed by "dipping" in nitric acid, after which the good qualities of the manganin are restored.

Surrounding the manganin with powdered charcoal during heating does not sufficiently preserve it against oxidation. Moreover, dipping in acid is impracticable with the finer wires. At first this question of rapid oxidation at annealing temperatures presented a great difficulty to manufacturers of manganin wire, but the wire drawers have now learnt how to draw manganin cold, even to very fine gauges, so that the trouble is very much lessened. By varnishing the finished coils with shellac, it is found that the wire is rendered proof against oxidation, at any rate up to 150° C.

Constantan, on the other hand, resists oxidation. It can be heated with impunity up to 300° C. On account of its strength and flexibility it can be drawn into fine wires or rolled into strips. For many electrical purposes—for instance, where considerable heating is to be expected—the qualities of constantan are of great value; but for standards of resistance manganin takes preference, chiefly because of its small thermo-electric power against copper. In joining manganin wires to the copper connecting pieces for standard resistances, tinman's solder was previously used, applied with a soldering iron. But this method is found to be detrimental; it produces in the course of time very perceptible changes in the resistance. The soft solder causes fissures, and generally alters the structure and properties of the manganin. The present method employed is to solder the wires with silver solder to copper lugs that are screwed under the contact pieces, so that they can be removed if necessary. All coils, after varnishing several times with shellac, are dried for some hours at 140° C. In winding, the insulated wire is not touched by the hand, but is passed through a clean dry cloth. The bobbins are made of as large diameter as possible, and other precautions are taken to avoid bending of the wire. It is often found better to use several thinner wires in parallel than a single thick one.

Elisha Moore, of Meductic, York County, New Brunswick, has invented an alternating switch for street railways which can be operated from the car by simply pressing a button. The device obviates the necessity of stopping the car and does away with switchmen, which means a great saving to railway companies. Mr. Moore has patented his device both in Canada and the United States and will now apply for European patents.

THE DISTRIBUTION OF ELECTRICAL ENERGY IN PARIS.

BY J. LAFFARGUE.

(Continued from page 311.)

La Compagnie d'Air Comprimé et d'Electricité.—At the outset this Parisian company had at their disposal two works—one established at the Boulevard Richard Lenoir and the other at Rue Saint-Fargeau. These two stations were supplied with a certain number of 500 volt dynamos connected in series, giving 1,500 volts, and two series were coupled for the supply at 3,000 volts of a network comprising 20 sub-stations with accumulators distributed within Paris. Each sub-station then constituted a special center for secondary distribution. Only three of these sub-stations are now in existence, and these are still supplied from the works at the Boulevard Richard Lenoir (1,000 kW.) and from those at Saint-Fargeau (1,300 kW.). But these sub-stations are shortly to disappear, and to be replaced by the system of distribution now to be described. It should be mentioned that the high-tension circuit is still connected to a sub-station at present utilized—the St.-Roch sub-station, where it supplies 12 rotary transformers of 80 kW. and four of 40 kW. at 120 volts. There are also two reserve stations, with motors working by compressed air, at the Bourse du Commerce and at the Rue des Jéneurs.

The distribution is at the present time effected in Paris by means of a network of five wires connected at various points to sub-feeders proceeding from the two sub-stations at the Rue St. Roch and at the Rue Mauconseil. These two sub-stations are themselves supplied each by means of three feeders of 1,000 square millimeters section from the large central station at the Quai Jemmapes. This station is established on the banks of the Saint-Martin Canal. In front are the offices, and to the left, passing from the ground floor to the second story, are to be found a repairing shop, a testing room and the accumulator room. The works, properly speaking, consist of an extensive longitudinal wing, which will be of the maximum length of 240 feet when all the machines are installed. The width is 45 feet. On the ground floor is the engine-room, which is 38 feet in height. At present it contains five Corliss steam-engines of the vertical compound type, of 1,200 HP., constructed by the Société Alsacienne de Constructions Mécaniques at Belfort. These machines, furnished at one side with an enormous flywheel of 31 tons, and with a small auxiliary steam-engine for starting, actuate directly, by means of a star wheel of 39 arms, a dynamo, with external collector and 12 internal fixed poles, giving 750 kW. at 500 volts, with 70 revolutions per minute. Two other similar machines are shortly to be installed. The guaranteed consumption of steam is 15 lbs. per brake horse-power hour.

The switchboard is fixed at the end of the room, upon a platform at the height of the first floor. Each machine is provided with a panel, to which are attached the measuring and regulating apparatus. All the instructions are given by means of optical signals, made with incandescent lamps of different colors placed near the machines, and which are lighted or extinguished by the electrician-in-chief according to the switchboard requirements. All the dynamos are connected in parallel, and the switchboard is connected by means of two bus bars with the board to which the feeder terminals are attached. On this board are arranged switches, which allow of the current being transmitted to the feeders either directly or through an adjustable resistance, according to the requirements of the service. On the first floor, above the machine room, are at the present time installed 20 multitubular Belleville boilers, having a fire-grate surface of 100 square feet, giving, at a pressure of 170 lbs. per square inch, about 6,800 lbs. of steam per hour. The 20 boilers are dis-

tributed in five sets of four each, each set having its own chimney flue and water tank. The coal is located in the false roofs above the boiler room, and is supplied in front of each boiler through hoppers arranged for this purpose.

Parallel with the first building just described is a second building of less importance, having in the basement a gallery from which proceed the cables, and on the ground floor stores and a shop for mechanical repairs. When the works are completed, this last building will be located in the middle; and, on the other side, there will be a building similar to the first-mentioned, and, like it, comprising an engine room, with ten engines of 1,200 HP., and a boiler room.

The distribution is wholly carried out by means of lead-covered armored cables, manufactured by the Société Alsacienne de Constructions Mécaniques of Belfort; they are laid directly in the earth, with a metallic trellis above them to give warning of their proximity. Three feeders, 1,000 square millimeters in section, proceed to the Saint-Roch sub-station, and three others, of the same sectional area, to the sub-station in the Rue Mauconseil.

The Saint-Roch sub-station contains two batteries of 280 Tudor accumulators, yielding 2,000 ampere-hours with a current of 600 amperes; and one battery of 280 cells, by the Société des Métaux, yielding 880 ampere-hours with a current of 300 amperes. These accumulators are charged from 12 Thury rotary transformers of 80 kW., and from four of 40 kW. The primary conductors of these transformers are supplied from the high-tension circuit of the Richard Lenoir and Saint-Fargeau works. The secondary circuits are coupled in parallel with the feeders at 500 volts from Jemmapes for the supply of the sub-feeders belonging to the five-wire distribution. The sub-station at the Rue Mauconseil contains four batteries of 280 accumulators from the Société pour le Travail de Métaux, having a capacity of 2,200 ampere-hours with the maximum current of 300 amperes. The starting point of the two stations is at the sub-feeders, with five wires supplying a network of distribution.

The total power at present at the disposal of the Cie. Parisienne de l'Air Comprimé is 3,600 kW. at the Quai Jemmapes works, and 2,325 at the Richard Lenoir and Saint-Fargeau works. At the end of the year 1896 the company had 1,504 subscribers, utilizing 1,713 arc lamps and 64,353 incandescent lamps. The motors for various applications were 90, having a total power of 350 kW.; there were in addition 44 electric lifts, absorbing a total power of 130 kW. As we have just seen, this company has completely transformed its system of distribution, and has definitely adopted that with five wires. The two old works are still in existence as well as a few sub-stations, but these are shortly to disappear. In any case, the new central station at the Quai Jemmapes constitutes a really magnificent work which is very well conducted.

The Municipal Works at the Halles Centrales.—The municipal works for the Central Markets were installed in 1889 in the basements belonging to the latter for the purpose of providing electric lighting for the Halles, and also to carry out some tentative distribution outside. The works contain in the boiler room six Belleville boilers giving 3,300 lbs. of steam per hour at the pressure of 210 lbs. per square inch. In the machine room there are three vertical Weyher and Richemond triple-expansion engines of 150 HP. at 160 revolutions per minute. These actuate by belting six Edison bipolar dynamos, yielding 40 kW. at 120 volts at the speed of 600 revolutions per minute. The cables from the machines are first connected to a special switchboard for coupling, and then to a switchboard for the feeders. Two of these supply the lighting to the Halles Centrales, consisting of 245 arc lamps of five and ten amperes and 743 incandescent lamps. The other feeders supply the distributing network established in some of the

neighboring streets to meet the requirements of a few subscribers and those of public lighting, notably that of the square of the Tour St.-Jacques and that of the Boulevard Sebastopol, which has recently been lighted from the Rue de Rivoli to the Rue Etienne-Marcel. The distribution is effected by means of insulated cables carried by lateral insulators within concrete subways, and also by means of lead-covered and armored cables laid directly in the ground. A trial of distribution by alternating currents has also been made. The installation comprises within the works three horizontal Leconteux and Garnier engines, of 170 HP., of the Corliss type, with tandem condenser. The speed is 180 revolutions per minute. Each of these machines actuates by means of belting a Ferranti alternator of 110 kW. at 2,400 volts, working at 530 revolutions per minute. A special countershaft has been installed which allows two steam-engines each to actuate during the day two Desroziers dynamos of 42 kW. at 170 volts for the purpose of charging two batteries of 72 accumulators of the Société des Métaux having the capacity of 2,000 ampere-hours.

(To be continued.)

ELECTRIC CABLES WITH DRY-AIR CIRCULATION.*

BY A. BARBARAT.

The telephone network in Paris is entirely underground, and up to 1893 it was made up entirely of gutta-percha covered seven-pair cable. The price of these cables and the cost of laying them was very high. The external diameter of the cables was from 0.82 to 0.87 in. When the transformation of the Paris telephone system was begun in 1893, with the object of diminishing the number of exchanges and erecting multiple boards, it was recognized that this type of cable would take up too much room and would be too heavy, and fifty-pair cables, first with cotton insulation and subsequently with paper insulation, were tried, the cables being entirely filled with paraffin. Each of these cables replaced seven of the seven-pair cables, and effected an economy of 40 per cent. in the cost of the lines to distribution centers, when the cost of laying the cables was taken into account in both instances. Up to the middle of 1894, 115 miles of this type of cable was laid, and then the adoption of cables with dry-air circulation became general. As mentioned above, the first cables, which were made by the Western Electric Company of America, were entirely filled with paraffin. Later patterns were only paraffined at the ends of each section for a distance of about 23 ft. This sealing of the ends of the sections was to prevent a disturbance, caused by a perforation in the cable, from extending to more than one section. The jointing, and more especially the repair, of these cables when laid in the sewers presented serious difficulties, and as a remedy I propose that cables should be manufactured in such a manner as to allow of the passage of dry air through them from one end to the other. On comparing the cost of such cables with that of the paraffined cables they replaced, and again taking account of the cost of laying and jointing, it is found that an economy of 68 per cent. was effected; that is to say, the cost was only about one-fifth that involved in the use of the gutta-percha-covered cable. As a result of this saving in cost, and of other considerations still more important in my opinion, all patterns of cables used by the French Administration of Posts and Telegraphs, whether for telephony or telegraphy, have been replaced by the type with dry-air circulation.

I will now describe the system of telephone cables employed at present in Paris. All new cables are ordered with paper insulation and dry-air circulation. No special process is specified to the contractor,

* Abstract of a paper read before the Société Internationale des Electriciens, March 2, 1895. From *The Electrician*, London.

who is free to use a longitudinal or a spiral paper covering. A certain tenacity is specified for the paper, but this is also to the interest of the contractor, as it would be impossible to manufacture the cable if the paper ribbon were too brittle. The thickness of the lead varies from 0.098 to 0.148 for the different types of cable containing 1, 7, 23, 56, 112 and 224 pairs. A maximum diameter is specified in each case, and a maximum capacity of 0.07 microfarad per kilometer (0.1126 microfarad per mile). The contractor is free to use a diameter smaller than the maximum specified, if he fulfils the other conditions, and this is of course to his interest, as the price of the cable can be diminished in that way, and it is a question of public tenders. The large cables of 56, 112 and 224 pairs are laid in sheet iron conduit, the others are fastened on hooks. Some of the large conduits near the central exchange in the Rue Gutenberg have as many as ten cables above one another. The cable heads are of wood. As it is impossible to make these wooden boxes sufficiently air-tight to withstand the pressure of air used, the end is sealed with paraffin, and the air is sent through a pipe tapped into the cable behind the seal. The joints are made without special precautions; the conductors are simply twisted together and covered with a paper tube, and the whole joint is covered with a lead sleeve soldered to the lead sheathing of the cables on either side. The cables end in distribution chambers, from whence they are distributed in seven-pair cables, and finally in single-pair cables to the subscribers. In these chambers cast-iron cable-heads are used, with double bottoms, but occasionally this distribution is made in the sewer itself by means of a special lead sleeve. Distribution from seven-pair to single-pair cables is usually made through a piece with seven tubes, but in rarer cases, where a single subscriber is far from such a distributing point, his single-pair wire has been tapped directly from the seven-pair cable.

The chief advantage of this dry-air system lies in the facility of making repairs. If the cable is damaged and the quantity of water which has penetrated into it is not great (this is shown by the insulation test), it is sufficient to force dry air through the cable. To hasten the drying action of the air the cable is heated where the fault is; the place is localized by an electrical test, and is easy to find by hearing the escape of the air. After some hours the insulation resistance will be high enough, the fault is soldered up and the repair is complete. If the cable has been completely soaked the same method is used, but it takes longer to dry the cable and it is necessary to shift the subscribers; but this happens less frequently. In Paris air from the mains of the Parisian Compressed Air Company is used; in large provincial towns Westinghouse pumps are usually employed. The air is dried by passing it through six large cylinders, 1 ft. diameter and 4 ft. high, containing calcium chloride. Cables more particularly liable to be covered with water in the sewers are kept continuously at a pressure of three atmospheres, and a meter shows as soon as there is a puncture. This is especially important when no spare cables are available.

Cables with dry-air circulation have even been used to replace long-distance underground lines. Thus a section 40 miles long has been laid from Marseilles to Toulon. This cable has six pairs of 2 mm. conductors. Faults have been dried out of this cable by means of a hand-pump and a portable dryer, but it is suggested to use the petroleum motors of motor-cars for the purpose of working the pump.

In articles published in the *Annales Télégraphiques* in May-June, 1894, I expressed the opinion that all gutta-percha covered telegraphic and telephonic cables should be replaced by dry air cables. I also added that these cables would be found useful for the transmission of electrical energy. At present, taking account of the results obtained, I am convinced that an experiment in this direction ought to

be made, and that the electrical industry would find important advantages from the point of view of economy and facility of repair. It would be very easy to maintain these cables under pressure, as explained above, and one would then be protected from interruptions due to the accidental perforation of the lead covering.

ON THE CATHODE-RAY SPECTRUM.*

BY M. BIRKELAND.

On September 28, 1896,† I had the honor to present to the Académie des Sciences a note on some experimental results obtained on deflecting suitably a very narrow beam of cathode rays by magnetic forces, in such a manner as to cause the deflected rays to be made manifest by phosphorescence on a glass surface beyond other luminosities which might trouble the phenomenon. By this means one recognizes a certain dispersion of the deviated rays, showing that they form themselves into different groups.

Recently Prof. J. J. Thomson‡ found that the appearance of this spectrum is always the same for discharges across different gases, provided that the mean differences of potential between the anode and cathode are also the same. He found besides that the same spectrum can be produced by deflecting the cathode rays by electrostatic instead of by electromagnetic forces. These results are easily understood by the following researches which I have just made, after having perceived that the appearance of the spectrum varies—sometimes even considerably—with different cathodes introduced successively into the same tube. It appears that it is less the different material forming the cathode than the details of its mechanical construction that is the cause of this. By taking certain precautions, however, one succeeds in obtaining regular and corresponding results for different tubes. I will describe some obtained with an ordinary aluminum cathode, in which the metallic contact between the different parts, and the contact with the conducting wire connecting the cathode to the negative pole of the large coil used, were as perfect as possible. In addition, precautions were taken before the experiments to carefully remove occluded gas from the tube and the electrodes, after which a sufficiently small quantity of pure hydrogen was introduced into the tube to prevent the potential difference between the anode and cathode at the moment of discharge from falling below 10,000 volts. During the discharges the cathode rays must emanate regularly from the middle of the cathode.

Taking account of the above remarks, I found, in a special spectrum, four yellow bands separated by dark bands. In each luminous band I often distinguished lines of more intense luminosity, and sometimes these lines appeared fairly numerous. To study these phenomena closely I introduced an adjustable water resistance in series with the cathode and connected to it by a short fine copper wire. By this means a single yellow band is obtained, which remains steady from one discharge to the next, and can easily be given a width of several centimeters by giving a suitable value to the resistance. The width of the band increases, moreover, with the primary current of the coil used, and, in addition, with a variable water resistance it has a very marked maximum. At the first glance this band appears to have a uniform luminosity, but on examining it attentively traces of an enormous number of lines are observed.

If, however, the copper wire connecting the water resistance with the cathode is joined to an insulated metallic ball (I employed spheres of 10 cm. and 30 cm. in diameter), the yellow band contracts and resolves itself into fine lines, changing their position now from one discharge to the next. It is easy to see, without counting, that these lines are much

more numerous when the 10 cm. sphere is used than with the 30 cm. sphere, other things being equal. The number of lines could be diminished at will by adding capacity. I used three Leyden jars, whose volume was 120, 750 and 1,200 cubic cm. respectively. With the first I estimated that there were about 30 lines, with the second I counted five, and with the third I rarely saw more than one. It must be observed, however, that with these capacities the number of lines increases with the primary current and diminishes when the water resistance is increased.

There is a means of separating the lines of these spectra from one another to any desired distance. If by trial one succeeds in closing the circuit of the deflecting magnets at the moment a discharge is taking place the spectrum widens considerably, and I have often succeeded, with the smallest Leyden jar, in producing on the glass a phosphorescent image of perfect beauty and almost identical with the images of intermittent discharges reproduced in a celebrated memoir of Feddersen's.* The rapid variation of the magnetic system plays the same part here as Feddersen's turning mirror in his experiments. By means of an automatic arrangement I made the magnetic field vary synchronously with the discharges, and in this manner I observed that the distance between the lines of the spectrum increases with the capacity and water resistance connected to the cathode. If, on the other hand, the capacity and water resistance are connected on the anode side we do not obtain the phenomena described above, but other results less marked and of a nature to confirm the theory. If the cathode plate is badly fixed to the leading-in wire the results are quite different. The spectrum in that case consists of large bands, which are hardly affected by the capacity and water resistance connected to the circuit. If the cathode rays emanate from different points, irregularly distributed on a cathode plate, the results are no longer well defined.

The phenomena which I have just described throw considerable light on M. Jaumann's discovery of interference surfaces of cathode rays. It appears to me also that this indicated differentiation of the discharge emanating from the cathode promises to throw more light on the question of stratification of the positive column. From a well-known experiment of J. J. Thomson's it is certain that the strata appear at first near the anode, and later on in the neighborhood of the cathode. But does it follow that the elementary discharges which are indicated by these strata are emitted by the anode? The strata do not exist in the neighborhood of the cathode; yet it is admitted that the elementary discharges are also propagated across this space. Now we know that the distance between the strata and the cathode depends greatly on the distribution of the electric force in the tube, and this distribution is quite different at the moment a discharge commences than it is later. On the other hand, M. Goldstein showed 16 years ago that properties of the simple and well-defined strata depend entirely on the nature of the cathode, and not at all on the conditions of the anode. I have just shown that the distance between the simple strata does not vary if one connects capacities to the electrodes; even small capacities connected as intimately as possible to the cathode and anode have no influence in this direction. The number of intermittent shocks creating the strata in unit of time is probably regulated, therefore, by the gas alone, or by the properties of the Grotthus chairs formed in it.

From what I have just described, I think that it would be most natural to suppose that the cathode emits: (1) Intermittent discharges whose properties are principally regulated by conditions exterior to the discharge tube, viz., the difference of potential between the anode and cathode, the capacities and the state of conductivity in the neighborhood of the cathode—these discharges create the cathode rays; (2) discharges whose properties are, above all, regulated

lated by the conditions of the gas in the tube—these discharges cause the strata.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Rates of Fare—Train Schedule, Etc.

NEW YORK, May 26, 1898.

Editor ELECTRICITY.

SIR: As already announced, the various passenger associations have granted a rate of a fare and one-third, on the certificate plan, for delegates and their friends attending the Chicago Convention of the National Electric Light Association, to be held June 7, 8, 9. Arrangements have been made to have the New York delegation leave Grand Central Station Sunday, June 5, via New York Central & Hudson River & Michigan Central Railroad, on New York, Boston and Chicago special train, leaving at 1 P. M.; Poughkeepsie, 2:43; Albany, 4:30; Schenectady, 5:05; Utica, 7:03; Syracuse, 8:35; Rochester, 10:47; Buffalo, 11:50 P. M., Central time; Detroit, 8 A. M., arriving in Chicago 3 P. M. Monday. The train leaving Boston at 10:30 A. M. Sunday, June 5, will connect with this train at Albany. This being a limited train, an excess fare of \$1 is charged, therefore the railroad fare is \$21 and the berth rate \$5, making a total of \$26.

In purchasing tickets, delegates should be particular to obtain a certificate from the agent from whom the purchase is made, as in the absence of such certificate no rebate can be allowed on the return fare. In case the number of delegates attending should warrant, a special train will be run as a second section to the train named. Tickets can be procured at any ticket office of the New York Central Railroad, and space reserved by applying to either the undersigned or to M. C. Roach, General Eastern Passenger Agent New York Central & Hudson River Railroad, 413 Broadway, New York. Yours very truly,

C. O. BAKER, JR.,

Master of Transportation, 136 Liberty St.

Reception Committee of the N. E. L. Association.

Mr. C. H. Wilmerding, chairman of the Reception Committee, Chicago, has sent out the following notice:

"The local members of the National Electric Light Association have organized a Reception Committee to provide for the entertainment of the visiting members of the Association, and this committee will advise later of the programme that is being arranged, but in the meantime it desires to offer its services, in the matter of securing hotel accommodations, to members who are going to attend the Convention. If we can be of any assistance to you in this matter kindly communicate with Mr. Jno. Jay Abbott, Secretary of the Reception Committee, No. 139 Adams street, Chicago, giving him full information as to what you want."

Electrical Appliances in South Africa.

It is said that the overhead trolley system is to be installed in the street railway system at Durban in Natal.

An electric lighting and street railway plant is being installed at East London, Cape Colony, at a cost of \$127,000.

Queenstown and Woodstock, both in Cape Colony, are considering the introduction of electric lighting plants.

There are excellent openings throughout South Africa for the sale of electric drills, electric cranes and electric elevators for mines and mills.

Through telegraphic communication has been established between Capetown and Blantyre, in British Central Africa.

The Bell Telephone Company have commenced work on their new exchange in the city of Quebec. The structure will be built of granite and will cost upwards of \$20,000. The switchboard will accommodate 3,000 subscribers.

* From the *Comptes Rendus* of January 17, 1898. Translation in *Electrician*, London.

† See *The Electrician*, Vol. XXXVII., p. 791.

‡ *Phil. Mag.*, Oct., 1897.

* *Pogg. Ann.*, 108, 1838, Plate I., Figs. 18 and 19.

THE NEW YORK ELECTRICAL SOCIETY.

Election of Officers—Annual Dinner.

The annual meeting of the New York Electrical Society was held at Madison Square Garden on Thursday, May 26. The following officers were elected:

President—Gano S. Dunn.

Vice-Presidents—Willard S. Case, H. B. Coho, Dr. C. A. Doremus, F. A. Pattison, E. E. Higgins, Charles Blizard.

Secretary—Geo. H. Guy.

Treasurer—H. A. Sinclair.

The Treasurer's report shows the Society to be in a prosperous condition. According to the Secretary's report, the membership last year was 397; this year there have been 215 members elected, 4 resignations and 1 death. There are now 607 members in the Society.

LIST OF MEMBERS ELECTED MAY 26.

B. B. Hoffman, Douglass Burnett, Leo R. Manheims, W. S. Atkinson, W. J. Schweiger, John O'Connor, Chas. H. Kienle, Wm. W. Rosenbaum, M. J. Adler, George J. Schoeffel, W. S. Alexander, E. Bradford Bumsted, Julius W. Eichler, Arthur H. Brown, Walter A. Houghaling, Sterns Francis Jones, I. W. Smith, James H. Campbell, Farley G. Clark, Chas. F. Bauer, James B. Faulks, Jr., Jos. Bijar, H. L. Shippey, H. H. Harrison, C. B. Taylor, George Clapperton, all of New York City.

G. A. Robertson, J. E. Sleight, Jr., Otto Kartzmark, all of Brooklyn.

Samuel Van Ronts, Syracuse, N. Y.

John W. Schroeder, O. A. Sandborgh, East Orange, N. J.

Albert Flammer, Fred Joorg, Jersey City, N. J.

Charles Moyer, Union Hill, N. J.

Adrian Chamberlain, New Brunswick, N. J.

F. W. Roebling, Trenton, N. J.

ANNUAL DINNER.

The annual dinner of the Society was held at the Hotel St. Denis on Friday evening, May 27; there were 100 guests, and the affair was a pronounced success. The following are the toasts and speakers:

"The Electrical Society," Gano S. Dunn.

"The American Institute of Electrical Engineers," Prof. Crocker.

"Sister Societies," Dr. W. McMurtrie.

"The Electricity of the Past," Dr. C. A. Doremus.

"Electrical Applications," F. W. Jones.

"The Newspaper Man," S. L. Coles.

"The Electrical Manufacturer," H. Ward Leonard.

"What We Think of Electrical Engineering,"

C. L. Eidlitz, C. O. Mailloux, M. I. Pupin.

"The Technical Colleges," Joseph Wetzler.

CANADIAN NOTES.

The Canadian Motor Syndicate is looking for a site for a factory, the purpose being to manufacture electric motor vehicles.

The Cataract Power Company of Hamilton, Ont., are engaged on an immense undertaking in the County of Welland, Ont., for the purpose of creating electricity on a large scale with a view of supplying power to any and every business industry that may require it in their line of route of upwards of 40 miles. At the De Cew Falls a very large reservoir is in course of construction, the water for which will be supplied from the Welland Canal at Allanburg, which is itself fed from Lake Erie, and which stands at a considerable elevation above the site of the new reservoir. Seven or eight other storage reservoirs are being made between De Cew Falls and Allanburg so as to have an abundant supply of water always on hand. At the De Cew Falls an immense power house has been erected and the water will be carried from the reservoir through pipes 8 feet in diameter, the fall from the reservoir to the power house in the valley below being about 100 feet.

LEGAL NOTES.

Suit for the dissolution of the Ohio Storage Battery Company and the appointment of a receiver for it has been commenced in the Common Pleas Court at Cleveland, O., by W. H. Marshall. He sets up that he is one of the stockholders of the company, owning more than one-fifth of its \$60,000 worth of paid-up stock. For the past three years, he alleges, the company has not been able to pay dividends, and for that reason he wants its career ended.

The U. S. Supreme Court on the 23d ult. rendered a decision in the franchise controversy adverse to the Detroit Citizens' Street Railway Company. The latter is the successor to the Detroit City Railway, which by an ordinance passed by the Detroit council in 1862 was exclusively authorized to construct and operate street railways in Detroit. By an ordinance of 1879 this right was extended thirty years. In 1894 an ordinance was passed granting to the Detroit Railway Company the right to construct railways upon some of the streets occupied by the Citizens' Company. The latter brought suit against the Detroit Company and the city of Detroit to prevent them from carrying out the terms of the ordinance of 1894, asserting that it violated a contract made with the Citizens' Company. The State courts held that the council had no power to grant exclusive right to the Citizens' Company, and their judgment was affirmed by the Supreme Court.

Judgment for \$28,356 has been entered against the Buffalo, Kenmore & Tonawanda Electric Railway Company in favor of John B. Dumont of Buffalo, N. Y., for the amount due on nineteen notes of the company, and also for money advanced to the company by the Erie Construction Company. The latter claim has been assigned to Mr. Dumont.

Judge Amidon of the U. S. District Court, in a telephone suit at Minneapolis, made the novel ruling that every street and avenue in the city on which United States mail is distributed is a post road and could therefore be used for stringing wires and poles for telegraph or telephone service. The judge intimated, however, that wires can be ordered underground if public interest demands it.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILROADS.

Albany, N. Y.—The Albany "Times-Union" suggests that the Albany, Helderberg & Schoharie Railroad Company will have a powerful rival in the system of electric roads which have been authorized and already begun work preliminary to construction to open up Greene and Schoharie counties and the southwestern end of Albany county. There are four roads in the system and they extend from Coxsackie to the village of Schoharie, a distance of 77 miles. The four roads are: The Coxsackie & Greenville Traction Company, the Oak Hill Traction Company, the Windham Traction Company and the Middleburg & Oak Hill Traction Company. Their combined capitalization is \$950,000. They were incorporated under the laws of the State in July, 1897, and in the following September were authorized by the State Railroad Commissioners to construct their roads.

Ann Arbor, Mich.—The Ann Arbor & Ypsilanti Electric Railroad Company has been merged into the Detroit, Ypsilanti & Ann Arbor Railroad Company.

Appleton, Wis.—The Fox River Valley Electric Railway Company is experiencing some difficulty in keeping the road through the slough, on which it will run cars to Menasha, in repair. The trouble is caused by muskrats, which abound in the slough. They dig holes in the clay and these are enlarged by the rise and fall of the water in the lake.

Cleveland, O.—The Akron, Bedford & Cleveland Electric Railway Company now owns two miles of the Cuyahoga Valley, starting at Cuyahoga Falls and extending in a southwesterly direction. This is one of the

most picturesque spots in Ohio, the river having worn through the cliffs until it now runs through a gorge 150 feet deep in places. The property includes the falls in the Cuyahoga River and the famed "Old Maid's Kitchen," a large cave. J. C. Mengensdorf, general passenger agent, told a "Leader" reporter a few days ago that the Akron, Bedford & Cleveland Electric Railway would soon have new equipment, giving more speed to the cars and cutting down the schedule time between Cleveland and Akron from two hours and ten minutes to one hour and fifty minutes. Each car will be equipped with four fifty horse-power motors, giving an aggregate power of 200 horse power to each car.

Frederick, Md.—F. S. Douglas of Millersville, Pa., has signed a contract with the Myersville & Catonsville Electric Railway Company for the construction of that company's road. The road will be five and a half miles long, and will run from Myersville to Middletown, connecting at the latter place with the electric road to Frederick, already in operation.

Georgetown, Ky.—The Georgetown Street Railway was recently purchased at the sale ordered by the Circuit Court by J. D. Grover for \$28,000.

Jackson, Miss.—A correspondent states that "the war clause in the franchise of the electric railway for Jackson postpones, but does not defeat, the road. When Sampson and Schley catch the Spanish fleet and sink it, the war will soon end, and then Jackson will have this much-needed convenience."

Jersey City, N. J.—The Street & Water Board on the 25th ult. adopted an ordinance permitting the North Hudson County Railway Company to substitute electricity for horses as the motive power on its Grovestreet line from Jersey City to Hoboken.

Marion, Ind.—The Union Traction Company and the Marion Street Railway Company have absorbed the interests of the Indiana Traction Company, and Mr. Clodfelter will retire from the railroad business.

Minneapolis, Minn.—The Twin City Rapid Transit Company, as soon as the new interurban line is completed, will commence giving regular street car excursions about Minneapolis and St. Paul, in which the principal points of interest in both cities will be visited. The excursions will be daily affairs during the warm months, from June to October. Special cars elaborately upholstered and with the latest modern conveniences, will be put on for that purpose and each of them will be provided with music of some kind. For a nominal fare Lake Harriet, Minnehaha and Como will be visited and the trip so arranged that in reaching and returning from these points the car would pass over different lines, thus giving a general view of the cities. Excursions will start from both cities.

Mt. Holly, N. J.—After the long struggle for supremacy between the Monmouth Traction Company and the New York & Philadelphia Traction Company, the announcement was made at the special meeting of the board of freeholders here on the 24th ult. that the two companies had about decided to stop fighting, pool their issues and either consolidate or arrange upon an equitable division of the disputed territory. The matter of awarding the franchise will not be considered until the regular meeting of the board, in July next.

New York.—The Metropolitan Street Railroad Company and the Third Avenue Railroad Company have made application to the Railroad Commission for permission to change the motive power on all their cable lines to that of the underground system of electrical propulsion. The Metropolitan has also made application to change the motive power on its horse lines to the underground system of electricity, or to compressed-air propulsion. Hearings will be given by the Commission on these applications on Thursday, June 2, at the Fifth Avenue Hotel, New York.

Peekskill, N. Y.—The Peekskill Traction Company has been granted an electric railway franchise running 25 years. Several changes were made in the franchise as originally presented and the company may decline to accept the amendments.

Red Bank, N. J.—The Chancellor has appointed James E. Degan of Red Bank receiver of the Atlantic Highlands, Red Bank & Long Branch Electric Railway, a trolley road operating between Belford, Red Bank and Long Branch.

Rochester, N. H.—The "Courier" states that it has reliable information to the effect that responsible parties are seriously considering the building of an electric road in Rochester with an extension to East Rochester.

St. Louis.—The court has ordered the case brought in the Supreme Court against the Central Traction Company dismissed on the ground that the proceedings were premature.

Victor, Col.—Representatives of the Canon City & Victor Electric Railway who were in town a few days ago stated that the old organization had been revived by the purchase of the right of way by a new company which has sufficient capital to complete the road and to equip it with the necessary rolling stock and electric appliances. Work is to begin immediately and will be rapidly pushed.

Washington, D. C.—The successful change from the cable system to the underground electric which has just been made on the 7th street line without stopping for an instant the daily running of the cars, is looked upon as something remarkable in the history of street railroad construction. It is probably the first time a work of this kind was ever attempted, and it was not believed by many that it could be done. However, the

contractor, Mr. Saxton, was confident that he could do it, and the result has shown that he was correct.

Westfield, N. J.—The Westfield township committee has passed the ordinance granting the Elizabeth & Westfield Street Railway Company the right to construct a trolley road through the township.

Westerly, R. I.—Work upon the Sea View Railway has been started, and before many weeks have passed, if no obstacle is encountered, people will have the opportunity to ride on trolley cars between Saunderson and Narragansett Pier.

Wilmington, Del.—The managers of the Wilmington City Railway Company have decided to build the trolley line between Chester and Wilmington over the route of the Philadelphia & Wilmington Turnpike Company, and a survey will be made at once.

LIGHTING PLANTS.

Albany, N. Y.—The "Times-Union" says: "The task of drilling the holes in the pedestals preparatory to installing the many electrolights which will illumine the front, sides and western staircase of the Capitol has nearly been completed. Holes have been made in twenty eight pedestals and the work of wiring has been inaugurated. Sixty men have been put to work doing this. Six weeks must see the entire lighting plant in operation, and the cost for the same will be \$24,000 for wiring and drilling and \$58,000 for the handsome electrolights, which will be the finest that artistic skill or money could provide. It has been in this spirit that the completion of the Capitol has been carried out, consequently a visitor beholds the finest work of which artisans are capable. The wiring is being done by the E. G. Bernard Company."

Atlanta, Ga.—Sealed proposals addressed to A. L. Koutz, clerk county commissioners roads and revenues, Fulton County, Atlanta, Ga., will be received until 12 o'clock M. on Saturday, June 25, 1898, for furnishing and erecting complete and ready for use a direct connected electric light plant for the new Fulton County jail, Atlanta, Ga., consisting of one 25 kw. generator, engine, sub-base, foundation, and necessary fixtures. Plans and specifications can be had upon application to Grant Wilkins, engineer, 94 Peachtree street, Atlanta.

Cass City, Mich.—At a special election here on the 23d ult. it was decided to bond the village for \$18,000 for the purpose of putting in an electric lighting plant and water works system.

Clyde, N. Y.—At a recent meeting of the village trustees a franchise was granted to the Clyde Electric Light & Gas Company, which is a renewal of the Clyde Gas Company's and the Clyde Electric Light and Power Company's franchises, the two companies being now consolidated.

Dundee, N. Y.—A movement is on foot here having in view the lighting of the streets by electricity.

Elkhart Lake, Wis.—This place will be lighted by electricity after July 1. Mr. Gottfried, a Chicago capitalist, is erecting a \$15,000 electric light plant. The latest and most improved machinery is being used.

Elma, Iowa.—The question of the city building and maintaining an electric light plant has been under discussion for some time, and since so many favor it the council have decided to give the citizens an opportunity to vote on the question. A special election for this purpose will be held June 10.

Elizabeth, N. J.—The Suburban Electric Light Company of this city has passed into the control of a syndicate which has, under the name of the Consumers' Electric Light, Heat & Power Company, filed articles of incorporation in the office of the county clerk, placing its capital stock at \$1,000,000. The Suburban Company, in addition to this city, supplies electric light to all towns on the line of the Central Railroad east of Fanwood. It is the intention of the syndicate to greatly enlarge the capacity of the plant, put in new engines, dynamos and other machinery, and to furnish power to operate the Elizabeth branch of the Consolidated Traction Company. The incorporators of the new company are George F. Chapman of Elizabeth; David Young, John W. Omberson and William O'Connor of Newark; W. J. Davis, Harrison; John E. McArthur of Jersey City; W. G. Shailer of New York.

Henning, Minn.—A few evenings ago a mass meeting of citizens took place at the opera house for the discussion of the advisability of putting in an electric light plant by the village. The sentiment was greatly in favor of so doing.

Newport, Vt.—C. A. Prouty is enlarging his electric lighting plant and intends to make such additions as will enable him to furnish power as well as light.

Rochester, Minn.—The electric light plant of this city, which has been run for four years, is to be reorganized at an expense of about \$10,000, and new dynamos put in to replace the antiquated machines with which the plant has previously been equipped.

Sea Isle City, N. J.—The borough council has advertised for proposals for supplying this resort with electric lights.

Syracuse, N. Y.—A subway franchise has been granted by the council to the Syracuse Electric Light & Power Company.

Uvalde, Tex.—The Uvalde Water, Ice & Electric Company will shortly begin work on the proposed electric light plant.

MANUFACTURING, ETC.

Baltimore, Md.—The "Herald" says: "Twenty American-made electric cars were recently delivered in Berlin, and one hundred more have been ordered, the cars manufactured over here being deemed to be superior to those with the Berlin brand. We are told also that the car-makers of Germany are not so reliable as those of the United States. Now we know why Herr Bismarck is against us in our war with Spain."

Laconia, N. H.—The Laconia Car Company has completed the shipment of 48 open cars for the Boston Elevated road. Work on the 50 closed electrics for the same road is in progress, and about a dozen of them are already set up in the electric department.

Lehigh, Pa.—The town council has awarded a contract for an electric light plant to the Fort Wayne Electric Company of Philadelphia for \$18,800, the plant to be completed within thirty days' time after signature of contract.

New York.—The "Journal of Commerce" says: "The latest advices from England to a local concern say that in the first week of this month the Chilean Electric Tramway & Light Company had been organized in London with a capital stock of \$5,250,000. This concern proposes to work and maintain a number of electrical undertakings in the principal cities of Chili, such as electrical railroads and electric light and power plants. Ingle, Holmes & Son, No. 20 Threadneedle street, London, are said to be the principal parties interested in this large corporation. It is generally believed that this company will begin active work very shortly. The quantities of material required will be thoroughly appreciated by manufacturers, and as American electrical material is to-day effectively competing the world over, some good contracts may be secured in the local market."

Stockholm.—During the last few months practical steps have been taken by the Swedish Government to utilize the celebrated waterfall of Elkarleby. For a long time it has been under consideration to utilize this enormous power for Stockholm. Engineers are said to be drawing plans to utilize about 20,000 horse-power. The total expenditure will amount to about \$2,160,000. Orders for the machinery and supplies for this Swedish plant will be forthcoming at an early date.

ELECTRICIANS IN THE WAR.

Among the appointments confirmed by the U. S. Senate last week were the following: First Regiment of Volunteer Engineers—To be Colonel, Eugene Griffin of New York; to be First Lieutenants: Algernon Sartoris of the District of Columbia; Fitzhugh Lee, Jr., of Richmond, Va.; Carlos Carbonel of Troy, N. Y.; Karl Fisher Hansen of New York. The President has nominated Samuel W. Campbell of Colorado to be a First Lieutenant in the above regiment.

A. D. Brown of Chester, Pa., for many years chief engineer for the Chester Electric Light Company, has been appointed an assistant engineer with the rank of Ensign in the U. S. Navy.

The H. J. Smith Electrical Works, on the banks of the Wanaque River, N. J., have been rushing out Government work since the outbreak of hostilities. The firm is making fuses for the explosion of submarine mines, torpedoes and shells.

Branch No. 5 of the National Brotherhood of Electrical Workers, Pittsburg, Pa., at a meeting on the 20th ult. resolved that the services of the members be tendered to the Government. J. W. Ecoff, W. A. Evans and F. D. Malone were appointed a committee to communicate with the Navy Department in regard to the matter. There are about eighty unmarried electricians in Pittsburg who are ready for war service.

Major Ruffner, chief of the engineer corps at Charleston, S. C., has received a large and powerful electric searchlight which will be mounted at once on one of the forts on Sullivan's Island. It will be operated from the electric plant already installed in the Mortar Battery and will be used to assist the patrol boats in watching the channel entrance at night. The harbor is now thickly "sown" with mines.

Recruiting for Col. Griffin's brigade of volunteer engineers is going on all over the country. The brigade is limited to a total of 3,500 men. The Washington "Star" says: "The engineer troops will be armed and drilled as infantry. They are line troops and must take their places in the line of battle when necessary. Their engineering duties will be the construction of and destruction of fortifications, field works, entrenchments, bridges, roads, railroads and tunnels, and will embrace field engineering work generally, besides map making and field reconnaissance work, photography, operation of stationary and locomotive engines, and electric apparatus, etc. Recruits, therefore, must be foremen, skilled mechanics of various sorts, handymen and first-class laborers, machinists, electricians, telegraph linemen, carpenters, timber framers, bracers, tunnel men, bridge men, iron men, erectors, riggers, blasters, quarrymen, lumbermen, boatmen and railroad men. Two cooks are also required for each company, also stationary and locomotive engineers and firemen. Allowances in addition to pay will be rations, bedding, all clothing, medicines and medical attendance. The volunteer troops will be disbanded and discharged as soon as the war is over, but no man should enlist, it is announced, unless he is prepared to serve for the full two years. Men should not be tempted to enlist by the hope that the war will be over in a month or two, and that then they can return home."

PERSONAL AND MISCELLANEA.

Arthur Bryant, an electrical engineer of Akron, O., received a letter lately from a firm of solicitors in England enclosing \$800 with which to pay his expenses to that country. He has been made the sole heir to property in England estimated to be worth \$50,000.

W. J. Hart of Saginaw, Mich., has resigned his position as general manager of the Interurban Railway. He will assume the management of the new Detroit, Lake Shore & Mt. Clemens Electric Railway, with headquarters at Detroit.

Sonichiro Matsumoto, a graduate of the Rensselaer Polytechnic Institute and now director of the Imperial Government Railway Department in Japan, was the guest of Mr. E. G. Bernard at Troy, N. Y., a few days ago. He is inspecting electrical apparatus in this country. Another Institute student, Ichisuke Fujitora, is now professor of Electrical Engineering in the Imperial University at Tokio.

"Buck" Davis, the notorious criminal, sentenced to Dannemora prison on the 25th ult. for six years for jail breaking, and who was wanted in Schenectady for the alleged murder of George R. Blodgett, the chief patent attorney of the General Electric Company, committed suicide in the Salem, N. Y., jail on the 28th by hanging.

One of the theaters in Munich, Germany, has an electrically operated stage. This stage is circular in shape, and three or four times larger than the play requires. It is divided into sections, or compartments, and can be rotated so as to present any section before the audience, all the machinery being operated by electricity. This arrangement obviates any intermissions between the acts, as each scene is arranged on one section, and while it is turned toward the audience the next is being arranged and in due course of time is moved around to face the audience.

Dr. Emma Sutro Merritt, recently elected president of the Sutro Electric Railway in San Francisco, is the eldest daughter of Adolph Sutro, the noted California pioneer and capitalist, now insane. Her husband, Dr. George Merritt, is a practicing physician in San Francisco, and she also was a medical practitioner until lately, when she gave up her practice to devote herself entirely to the management of the railroad and the Sutro estate. So far as the railroad is concerned, she has ideas of her own as to its management. She is not ignorant of electric railways. While at college she took a scientific course, and electricity has always been one of her hobbies. She is intensely modest and retiring and has no desire to shine as a woman of affairs. Nevertheless it is predicted that she will make a distinguished success as a railway president. She is a woman of the broadest culture and education, and though she has devoted her life to medicine, she is by no means a physician merely. She is of middle age and strongly resembles her father in physical characteristics. From Vassar she was graduated with honors in 1877. Upon her return to San Francisco she entered Toland Medical College, where she received her degree in 1881. She is also a graduate of the School of Medicine in Paris. After several years of practice in San Francisco she and her husband went abroad three years ago, where they pursued studies in the largest European hospitals. Mrs. Merritt was one of the founders of the San Francisco Children's Hospital.

RECENT COMPANY ELECTIONS.

Chester & Derry Electric Railroad Association (trolley company), Chester, N. H.—President, C. S. Campbell; superintendent, Charles Bartlett; treasurer and general manager, F. J. Shepard; clerk, A. H. Wilcomb; directors: the officers and G. K. Bartlett, N. W. Goldsmith and Geo. Sherman West.

Camden & Suburban Railway Company, Camden, N. J. Secretary, Samuel T. Corliss, to succeed Morris W. Hall, deceased.

Laurel Electric Light Company, Laurel, Md.—President, C. F. Shaffer; vice president, C. H. Stanley; secretary, George W. Waters; treasurer, F. W. Awalt. The old board of directors were re-elected with the exception of Robert Morang, of Savage, who was chosen to fill the vacancy caused by the death of Dr. Snowden.

North Jersey Street Railway Company, Jersey City.—President, Edward F. C. Young, vice J. K. Carrière, resigned; vice-president, David Young, in place of H. W. Doremus, resigned; secretary, Wilbur F. Johnston; treasurer, E. N. Hill; auditor, E. D. Hobbs. The North Jersey Street Railway now controls the following organizations: Consolidated Traction Company, Jersey City & Bergen Railroad Company, Jersey City, Harrison & Kearny Railroad Company, Newark Passenger Railroad Company, New Jersey Traction Company, Passaic & Newark Electric Railway Company, Passaic & Newark Electric Traction Company, Newark Plank Road Company, Port Richmond & Bergen Point Ferry Company, Bergen Point & Staten Island Ferry Company, and Newark & South Orange Railroad Company.

COMMERCIAL PARAGRAPHS.

The Electric Appliance Company, Chicago, have recently concluded the general distribution of their Fan Catalogue for the season of 1898. In sending out catalogues to a very large list of buyers it is very often the case that some are overlooked. The Electric Appliance Company would be very pleased to hear from any of the trade who have not received a copy of this handsome catalogue, as they are anxious to place the same in the hands of every possible user or purchaser of fan motors.

INCORPORATIONS.

The Home Electric Company, Brooklyn, N. Y.—to manufacture and sell electric goods, machinery and supplies. Capital stock, \$25,000. Directors: Walter S. Pierce and Joel W. Thorne, New York City, and James H. Mason of Brooklyn.

The Penn Electrical & Manufacturing Company, Irwin, Pa. Capital stock, \$12,000. Directors: David M. Waggoner, Frank C. Hackensmith and Jesse L. Wagoner, Irwin; John A. Wright and W. F. O'Neill, Wilkinsburg.

The Creager Electric Light & Power Company, Fremont, O. Capital stock, \$50,000. Incorporators: Frank Creager, J. H. Clauss, John M. Sherman, Horace B. Buckland and Samuel Brinkerhoff.

The Electric Supply & Fixture Company, Decatur, Ill. Capital stock \$2,500. Incorporators: C. E. Gibson, G. B. Marshall and E. H. Coleman.

The Suffolk Gas & Electric Light Company, Islip, N. Y.—to furnish gas and electricity for lighting and power to the towns of Babylon and Islip, L. I. Capital stock, \$200,000. Directors: Charles F. Street, Hunter Wykes and William B. Hood.

The Army Post Street Railway Company, Little Rock, Ark. Capital stock, \$60,000. Incorporators: M. D. L. Cook, E. Meek, L. W. Cherry, Maxwell Coffin, J. H. Hollis and B. Bodeman.

The Shelby Electric Company, Shelby, O., has filed a certificate of increase of capital stock from \$100,000 to \$250,000.

The Lodi Light, Heat & Power Company, Lodi, N. J. Capital stock, \$100,000. Incorporators: Frank T. Ternes, Philip S. Hoffman and Charles I. Ternes, all of New York.

The Clyde Gas & Electric Company, Clyde, N. Y. Capital stock, \$40,000. Directors: Lucius L. Moses, George H. Lang and Charles W. Field, of Clyde; Edward Moir and John M. Moir, of Marcellus, N. Y.

The Asbury Park & Sea Girt Railroad Company, Asbury Park, N. J.—organized to acquire the franchises and effects of the Asbury Park & Belmar Railway Company, sold or to be sold under the direction of the Circuit Court of the United States. Capital stock, \$100,000. Incorporators: John E. Comins, Arlington; Daniel H. Shea and H. B. Perrine, New York.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 24, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

- 604,679. Incandescent-Electric-Lamp Regulator. Daniel McF. Moore, New York City, assignor to the Moore Electrical Company, same place. Filed Feb. 10, 1892.
- 604,680. Electric-Lamp Regulator. Daniel McF. Moore, New York City, assignor to the Moore Electrical Company, same place. Filed Oct. 18, 1894.
- 601,641. Inter-upter for Electric-Lighting Systems. Daniel McF. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Dec. 3, 1895.
- 604,683. Electric-Lighting Apparatus. Daniel McF. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Feb. 15, 1897.
- 604,686. Apparatus for Producing Luminous or Similar Effects. Daniel McF. Moore, Newark, N. J. Filed July 3, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 614,544. Electrical Governor. Mark A. Replogle, Akron, Ohio. Filed Feb. 19, 1897.
- 604,682, 644,683. Magnetic Circuit-Breaker. Daniel McF. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Sept. 8, 1896.
- 604,684. Automatic Vibratory Interrupter. Daniel McF. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Dec. 17, 1896.
- 604,687. Circuit-Interrupting Mechanism. Daniel McF. Moore, Newark, N. J. Filed Sept. 9, 1897.
- 604,688. Circuit Interrupter. Daniel McF. Moore, Newark, N. J. Filed Sept. 10, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 601,373. Automatic Telephone-Exchange. Ward Decker, Owego, N. Y. Filed March 25, 1895.
- 601,431. Telephone Signal System. Wallace A. Stillwell and Alexander Barneck, Salina, Kan. Filed Nov. 10, 1896.
- 601,499. Multiple Telephony and Telegraphy. Richard Pfund, New York City. Filed Oct. 22, 1897.
- 601,533. Combined Transmitter and Receiver. John M. Joy, New York City, assignor to the Printing Telegraph News Company, same place. Filed June 21, 1897.

METERS.

- 601,459 (filed March 20, 1897); 601,460 (filed Aug. 6, 1897); 601,461 (filed Aug. 6, 1897); 601,462 (filed Aug. 11, 1897); 601,463 (filed Aug. 26, 1897); 601,464 (filed Sept. 11, 1897); 601,465 (filed Sept. 24, 1897); 601,466 (filed Nov. 8, 1897). Electric Meter. Thomas Duncan, Fort Wayne, Ind.
- 601,501. Motor-Wattmeter. Carl D. Raab, Kaiserslautern, Germany. Filed Dec. 27, 1897.

MISCELLANEOUS.

- 604,344. Electric Heater. Edward E. Gold, New York City. Filed Oct. 14, 1897.
- 604,418. Accumulator-Plate. Isidor Rosler, Berlin, Germany, assignor to Lehmann & Mann, same place. Filed March 10, 1898.
- 604,431. Electric Signal for Railway-Crossings. Leon C. Smith, Columbus, Ohio. Filed May 18, 1897.
- 604,453. Secondary Electric Clock. Aaron D. Blodgett, Newton, Mass. Filed May 29, 1897.
- 604,503. Electric Clock. William Whitehead, Manchester, England. Filed June 7, 1897.
- 601,588. Storage Battery. Herbert S. Lloyd, Philadelphia, Pa. Filed Dec. 28, 1896.
- 604,616. Electrical Lighting Device for Kerosene or Other Burners. Svend M. Meyers, Brooklyn, N. Y. Filed Jan. 27, 1897.

DESIGN.

- 28,697. Switchboard for Telephone Operators. William F. Smith, San Francisco, Cal. Filed April 18, 1898.

TELEPHONE AND TELEGRAPH.

At the request of the defendant's attorneys, Judge Swan has granted a postponement until July 12 of the preliminary hearing in the injunction suit brought by the Western Electric Company against the Detroit Telephone Company. William M. Holmes, who appeared for the Detroit Company, addressing the Judge, said: "This action on the part of the Western Electric Company has been incubating for a long time, your honor. They have sat on the egg for years, and now they seek to hatch it by coming in here and, in giving us only brief time to answer their charges, interfere with our business and the 16,000 customers we represent." Attorney George Barton, of Chicago, for the plaintiffs, offered to telegraph to Washington and within two days get Mr. Holmes all the data he needed on foreign patent rights. "Which only confirms the rumor I have long heard," said Mr. Holmes, "that the Bell Company has the Patent Office right under its thumb."

The Home Telephone Company's franchise passed by the city council of Pittsburg, Pa., expired at the end of May, the company having failed to meet the promises it made when the rights were given away. May 30 of this year the concern was to have had its pole and conduit systems completed and 1,600 telephones in operation. Each succeeding year until 1900 a like number of 'phones were to have been placed and put in operation. Comparatively little work has been completed since the franchise was granted. The company now asks that it be given until May 30, 1899, to place 1,000 'phones, and that it be given until 1901 to place another thousand, instead of the arrangement provided for in the original franchise. The ordinance was referred to the corporations committee.

Mayor Taggart of Indianapolis has signed the New Telephone contract. The company has deposited its cash forfeit of \$25,000 and given an additional bond of \$25,000 to ensure the faithful performance of its contract with the city. The company is also required to file a bond of \$10,000 as a guarantee of indemnification to the city from judgments for damages. Of the cash forfeit it has been provided that the company is to receive back \$10,000 when the conduits are built within the one one-mile square, \$5,000 when the overhead wiring is completed, \$5,000 when the plant is completed and \$5,000 when the system has been in operation three months. The company will begin work immediately.

The Helena, Mont., *Independent* says: "Before the close of 1898, the people of Helena and other towns and cities in Montana connected with the Rocky Mountain Bell Telephone system will be talking with those of Portland, Ore., and possibly with other coast cities. In less than a week, a construction crew will commence work upon a telephone line which will connect Missoula with Wallace, Ida., which is connected with Portland and intermediate points. When the breach is completed, a business man in any of a score or more Montana towns may call up Portland and give an order for goods or take one themselves."

The Western New York Telephone Company, recently incorporated with a capital stock of \$500,000, has certified to the Secretary of State at Albany an extension of its telephone lines. The extreme points to be connected are Dover, Del., Erie, Pa., and Buffalo, N. Y. The lines will run through the various cities, villages and towns of Erie, Niagara, Orleans, Genesee, Cattaraugus, Chautauqua and Monroe counties and in the towns, villages and cities of the other counties included in the Second, Third and Fourth Judicial Departments of New York State.

A Terre Haute, Ind., correspondent of the *St. Louis Chronicle* says that a great interest in telephone matters has developed in Terre Haute. W. P. Ijams, president of the American Trotting Association, is at the head of a company that has bought an old franchise which provides for an aerial plant, and B. F. Havens has an incorporated company which wants a franchise for a conduit system. Both companies promise connection with more than 100 telephone companies in the State.

Senator Gorman's amendment to the War Revenue bill provides that from and after the passage of the act every firm, person, company, etc., owning or possessing or managing any telegraphic line by which telegraphic or telephonic messages or dispatches are received or dispatched, or carrying on the business of furnishing electric light or power, etc., whose gross annual receipts exceed \$250,000, shall be subject to pay annually a special excise tax equivalent to one-half of 1 per cent on the gross amount of all receipts of such persons, firms, etc.

A recent dispatch to the *Detroit News* from Three Rivers, Mich., says: "Last July the Three Rivers Telephone Company started out to compete with the Bell company in establishing their system in this city. The Bell people met them with a reduction of rates, even going so far as to offer

to put in 'phones for nothing in some cases. Notwithstanding the opposition, the home company has gone steadily forward and now have over 120 'phones at work. In addition to this they have a good system of State line connections."

The Maryland, Pennsylvania & West Virginia Telephone & Telegraph Company has made arrangements to extend its system, and has entered into a 15-year contract with the Union Telephone Construction Company. In Pennsylvania it has exchanges at Conellsville and Uniontown. Another will be installed at Dunbar, and the lines will be extended eventually to Pittsburg.

A representative of the National Telephone Company of Chicago has made a proposition to the people of Evansville, Ind., to put in a highly improved telephone system with copper wires, the rates to be \$2 per month for business houses and \$1.50 for residences. The Evansville Manufacturers' Association has taken the proposition into consideration with that of other independent companies applying for franchises in Evansville.

The annual meeting of the stockholders of the International Bell Telephone Company, Limited, was held in New York on the 25th ult. The following directors were elected: Samuel D. Babcock, Louis A. Von Hoffmann, Richard A. McCurdy, Charlton T. Lewis, Ellisha S. Converse, Ferdinand M. Theriot, Howard S. Randall, Louis A. Thebaud and Charles J. Bell.

The D. A. Tyson Telephone Company has completed all but a few miles of its long-distance line between Macon and Savannah, Ga. From Macon to Savannah the line is about 175 miles, coming by way of Dublin, Swainsboro, Statesboro and other intermediate points. It branches out from Swainsboro to Mount Vernon and other points near the Georgia and Alabama Railroad.

There is a report circulating in Wilmington, Del., that the Delmarvia Company is to pass into new hands. The *Wilmington News* of the 23d ult. says it was definitely stated on the previous evening that parties have been taking a great interest in the company and are bargaining for its control.

At the annual meeting of the stockholders of the Western Union Telegraph Company in New York on the 25th ult., the retiring board of directors was re-elected, with the exception of Messrs. Van Horn and Rochester, who were replaced by J. Merrihew and G. W. E. Atkins.

Manager McDonald of the Telephone Exchange at Augusta, Ga., has resigned his position and will take charge of a new electrical company, known as the Augusta Electric & Construction Company, as general manager.

The Kinloch Telephone Company expects to be able to begin service in St. Louis about the 1st of August. It is thought that by that time the 4,000 subscribers of the company in the city will all be connected with the main office.

B. L. Piggott and Noah E. House have just completed a telephone line between Piggott and St. Francis, Ark. They will likely extend it to Boydsville where it will connect with the Corning line.

A telephone system is being established at Cheraw, S. C., by Kirkwood & Thomason. It will connect with the network of 'phones throughout the Pee Dee section.

A long distance telephone line connecting Vicksburg with Jackson, Miss., has just been completed.

New Companies Incorporated.

The Carroll County Telephone Company, Carrollton, O. Capital stock, \$10,000. Incorporators: Union C. De Ford, H. J. McGranahan, J. C. Patterson, A. L. Iden and Simeon Ashbrook.

The Mens Telephone Company, Mens, Ark. Capital stock, \$5,000. Incorporators: H. M. Quigley, Edward Keogh and J. S. Kelley.

The Badger State Long Distance Telephone Company, Baraboo, Wis.—to own and operate lines in Wisconsin. Capital stock, \$100,000. Incorporators: F. T. Brewster, F. A. Philbrick and W. H. Hatch.

The Columbia & Montour Telephone Company, Bloomsburg, Pa.—organized to compete with the Bell Company in the section of Pennsylvania for which it is named. Capital stock, \$50,000.

The Pike County Telephone Company, Pittsfield, Ill., has certified to an increase of capital stock from \$3,600 to \$5,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.	NAME.	Capital Stock.			Rate and Date of Last Div.	Bid.	Asked.
	Par	Authoriz'd	Issued.					Par	Authoriz'd	Issued.			
Albany, N. Y.—May 28:													
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q. Feb. '98.	142 1/2	145 1/2	Hartford Conn.—May 28:	100	\$4,000,000	\$200,000	8 % S. Jan., '98.	140	--
Troy City Railway Co.	100	2,000,000	2,000,000	1 1/2 % Q., Dec. 10, '97.	66	68	Hartford & West Hartford RR	100	1,000,000	247,000	.....	--	--
Traction Co. (Saratoga)	100	80,000	80,000	.....	..	..	Holyoke Mass.—May 28:						
Allentown, Pa.—May 28:													
Allentown & Lehigh Val. Trac. Co	....	4,000,000	1,800,000	.....	..	15	Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	200	205
Bridgeport, Conn.—May 28:													
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	Hoboken, N. J.—May 28:						
Baltimore, Md.—May 28:													
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72	North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	--
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 1/2 % S., Jan. 15, '98.	22 1/2	23 1/2	Indianapolis, Ind.—May 28:						
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2	Citizens' Passenger Ry.	....	5,000,000	5,000,000	.....	24	25
Boston, Mass.—May 28:													
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..	Lancaster, Pa.—May 28:						
North Shore Traction Co.	100	4,000,000	4,000,000	.....	10	13	Pennsylvania Traction Co.	100	10,000,000	9,900,000	.....	--	--
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S. A. & O.	72	75	Lancaster & Col. Electric Ry.	....	.....	87,500	.....	--	--
West End Street Ry. Co.	50	10,000,000	9,085,000	4 % S., Oct., '97.	83 1/2	84	West End Street Railway	....	.....	.....	.....	--	--
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	103 1/2	108 1/2	Louisville, Ky.—May 28:						
Boston Elevated R. R.	100	10,000,000	.....	.....	60 1/2	61	Louisville Ry.	100	4,000,000	3,500,000	1 1/2 % Oct., '97.	30	35
Brooklyn, N. Y.—May 28:													
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	185	..	Louisville Ry.	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	87	94
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	.....	41 1/2	42	Minneapolis, Minn.—May 28:						
Brooklyn Heights Railroad	....	200,000	200,000	.....	..	..	Twin City Rapid Transit	100	17,000,000	15,010,000	.....	14	20
Brooklyn City RR.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	205	207	Twin City Rapid Transit	....	8,000,000	1,714,200	1 1/2 % Jan., '98.	--	100
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	.....	..	..	Montreal, Canada.—May 28:						
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1 1/2 % Oct. 1, '97.	140	..	Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S. M. & N.	258	258 1/2
Kings County Elevated	....	4,750,000	4,750,000	.....	..	..	Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S. J. & J.	97 1/2	97 1/2
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	46	47	Memphis, Tenn.—May 28:						
Nassau Electric Railroad	....	6,000,000	6,000,000	.....	..	87 1/2	Memphis Street Railway Co.	100	500,000	500,000	.....	15	--
Atlantic Avenue Railroad	50	2,000,000	2,000,000	.....	74	80	New Haven, Conn.—May 28:						
Brooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	.....	..	..	Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	60	..
Buffalo, N. Y.—May 28:													
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	.....	58	60	New Haven Street Railway Co.	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60	80
Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79 1/2	81 1/2	New Haven & Centerville	100	700,000	800,000	.....	..	..
Columbus O.—May 28:													
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	48	50	Winchester Avenue RR.	25	1,000,000	600,000	.....	40	42
Columbus Central Street Railroad	100	1,500,000	1,500,000	.....	..	..	New Orleans, La.—May 28:						
Charleston, S. C.—May 28:													
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..	Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	140	160
Enterprise City RR. Co.	25	1,000,000	250,000	.....	..	..	New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	123 1/2	126
Chicago, Ill.—May 28:													
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, '97.	..	246	New Orleans Traction Co.	100	5,000,000	5,000,000	.....	1	2 1/2
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	.....	123 1/2	12 1/2	New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	.....	5	7
Lake Street Elevated RR.	100	10,000,000	10,000,000	.....	..	8 1/2	a Crescent City RR.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	30
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	.....	..	..	b New Or. City & Lake RR.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	88
Met. West Side El. const. stk.	100	15,000,000	2,500,000	.....	..	..	Orleans Railroad	50	500,000	185,000	1 1/2 % S., June, '94.	16	17
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., '98.	198	199 1/2	St. Charles Street Railway	50	1,000,000	1,000,000	1 1/2 % S., Jan., '98.	58 1/2	64 1/2
North Chicago City RR.	100	500,000	249,900	.....	..	..	New York—May 28:						
South Chicago City Railway	100	2,000,000	1,603,200	.....	..	..	Central Crostown RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	200	..
West Chicago St. RR. Co.	100	20,000,000	18,189,000	1 1/2 % Q., Feb. '98.	91 1/2	92	a Christopher & 10th St. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	154	164
Chicago West Div. Ry.	100	1,250,000	624,900	35 %	..	..	Dry Dock, E. Bldg'g & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	175	195
Chicago Passenger Ry.	100	2,000,000	2,000,000	5 % S.	..	..	d Metropolitan Street Ry. Co.	100	30,000,000	30,000,000	1 1/2 % Q., Jan., '98.	159 1/2	160
Cincinnati, Ohio.—May 28:													
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000	.....	..	20	e Bleeker St. & Fulton Ry. Co. guar.	100	900,000	900,000	3 % A., July, '97.	32	88 1/2
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2 1/2 % S., Feb., '98.	..	75	f Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	265	212
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000	.....	28	25	g Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 1/2 % Q., Jan., '98.	170	180
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	118	h Eighth Avenue RR.	100	1,000,000	1,000,000	.....	300	325
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.	..	..	i 42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 1/2 % Q., Feb., '98.	320	360
Cleveland, Ohio.—May 28:													
Aaron, Bed. & Oliv. Elec. Ry.	100	1,000,000	1,000,000	3 % Jan., '98.	89	40	j Ninth Avenue RR.	100	800,000	800,000	.....	192	194
Cleveland City Ry.	100	8,000,000	7,600,000	3 % Oct., '97.	55	60	k Sixth Avenue RR.	100	2,000,000	2,000,000	.....	200	210
Cleveland Electric Ry.	100	12,000,000	12,000,000	3 % Q., Oct., '97.	50	58	l Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 % Q., Feb., '98.	810	..
Detroit, Mich.—May 28:													
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	.....	100 1/2	..	m Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	168	171
St. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..	n Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	178	180
Rapid Railway Co.	100	250,000	250,000	.....	..	100	o 42d St. Manhattan & St. Nich. Av.	100	2,500,000	2,500,000	.....	57	60
Detroit Electric Railway	100	1,000,000	1,000,000	.....	..	110	p Union (Huckleberry) Ry.	100	2,000,000	2,000,000	.....	175	200
Wyandotte & Detroit River Ry.	100	250,000	200,000	.....	..	..	Newark N. J.—May 28:						
Dayton O.—May 28:													
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102	Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	.....	47 1/2	48 1/2
City Railway Co. pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98.	140	145	Newark Passenger Ry.	100	6,000,000	6,000,000	.....	180	190
People's Street Railway	100	1,100,000	.....	.....	100	..	n Rapid Transit Street Ry.	100	504,000	504,000	1 1/2 % A.	..	..
Pittsburg, Pa.—May 28:													
Allegheny Traction Co.	50	500,000	500,000	.....	..	46	Unlisted.						
Consolidated Traction Co.	50	15,000,000	15,000,000	2 % Jan., '98.	..	14 1/2	a Consolidated of Baltimore Traction Company and City & Suburban Railway Company.						
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 % May, '97.	45 1/2	46 1/2	Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.						
Central Traction Co.	50	1,500,000	1,900,000	.....	..	..	Federal St. & Pleasant Valley Ry.						
Citizens' Traction Co.	50	8,000,000	3,000,000	6 % A.	..	..	Pgh., Allegheny & Man. Trac. Co.	25	1,400,000	1,400,000	2 1/2 % Jan., '98.	23 1/2	..
Duquesne Traction Co.	50	8,000,000	3,000,000	8 % A.	..	..	Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	2 1/2 % Aug., '98.	..	..
Pittsburg Traction Co.	50	2,500,000	1,900,000	3 % Aug., '96.	..	..	Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, '97.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 1/2 % Jan., '98.	..	..	Second Avenue Traction Co.	50	4,000,000	14,000,000	.....	..	..
Pgh., Allegheny & Man. Trac. Co.	25	8,000,000	2,994,889	2 % Aug., '98.	..	..	Suburban Rapid Transit Co.	50	800,000	200,000	.....	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	1 % Jan., '98.	..	100 1/2							
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, '97.	..	..					
Second Avenue Traction Co.	50	4,000,000	14,000,000	.....	..	..				
Suburban Rapid Transit Co.	50	800,000	200,000	.....	..	..				

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Author's'd	Issued.						Author's'd	Issued.			
New Bedford Mass.—May 28:							Boston, Mass.—May 28:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2 % Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,000,000	4 1/2 % Q. Jan., '98.	208	209
Northampton, Mass.—May 28:							Erle Telegraph & Telephone Co.....	100	.....	.....	1 % Q. Jan. '98.	68	69
Northampton Street Ry.....	100	800,000	225,000	4 % A., Jan., '98.	165	175	New England Telephone Co.....	..	10,804,800	10,804,800	\$1.50 % Feb. '98.	128	..
Omaha, Neb.—May 28:							New York.—May 28:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2 % Q	..	98 1/2
Paterson, N. J.—May 28:							*Central & South Am. Tel. Co.....	100	6,500,000	4,500,000	1 1/2 % Q	101	108
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1 1/2 % Q	174	175
Providence, R. I.—May 28:							Franklin Tel. Co..... 2 1/2 % guar.	100	1,000,000	.....	1 1/2 % Q	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	1/2 % Jan. '98.	59	62	Erle Telegraph & Telephone Co.....	100	5,070,000	4,800,000	1 1/2 % Q	88	89
Philadelphia.—May 28:							*Gold & Stock Tel. Co. guar. 6 %	100	8,000,000	.....	1 1/2 % Q	109	111
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	1,770,000	2 % Dec. '97.	14 1/2	..	*International Ocean Tel. Co. guar. 6 %	100	2,000,000	.....	1 1/2 % Q	108	108
Hestonville, Man. & Fairmount....	50	1,946,100	1,946,100	2 1/2 % July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000	.....	1 1/2 % Q	80	85
Hestonville, Man. & Fairmount....	50	522,900	522,900	8 % S—Jan. 10, '98.	64 1/2	66	*New York & New Jersey Tel. Co.	100	8,000,000	8,728,000	1 1/2 % Q. Jan., '98.	142	145
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	8 % Feb. 1, '98.	68	66	*Pacific & Atlantic Tel. guar. 4 %	25	2,000,000	.....	2 % S.	78	78
Union Traction Co. \$12 1/2 pd.	50	80,000,000	29,930,450	.....	15 1/2	16	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1 1/2 % Q	..	..
Electric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5 %	25	960,000	859,525	2 1/2 % Q	85	..
*Citizens' Passenger Ry.....	50	500,000	.....	.....	27 1/2	..	*Commercial Union Telegraph Co..	25	800,000	800,000	8 % S., Jan. 1 '98.	111	118
*Frankford & Southwark Pass. R.	50	1,000,000	1,875,000	\$14 share A—Apr. 97	890	..	Western Union Telegraph Co.....	..	97,870,000	.....	1 1/2 % Jan., '98.	91 1/2	91 1/2
*Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	47	..	*Div. guar. by Postal Tel. Co.	..	.....	.....	.....	..	..
*Lombard & South Street Ry....	25	.....	1,000,000	A. & O.	89	90 1/2	Miscellaneous.—May 28:						
*Second & Third Streets Ry....	50	1,000,000	.....	.....	235	246	American Dist. Tel. (Phila.).....	25	400,000	.....	1 % Q. Feb. '98.	14	..
*People's Traction Co.....	50	10,000,000	16,000,000	8 % A., April, '97.	182 1/2	185	Bell Tel. Co. (of Canada).....	100	8,168,000	8,168,000	2 % S.	170 1/2	178
*Germantown Passenger Ry.....	50	1,500,000	1,572,900	\$5.25 share—1898.	185	..	Chesapeake & Potomac Tel. Co..	100	.....	.....	.....	48	..
*Green & Coates Passenger Ry....	50	500,000	150,000	8 % Jan., 1898.	185	..	Chicago Telephone Co.....	100	.....	.....	.....	302	..
*People's Passenger Ry..... com.	25	1,500,000	740,000	.....	..	..	Central Dist. Prtg. & Tel. Co. (Pgh.).	100	750,000	750,000	.....	68	76
*People's Passenger Ry..... pfd.	25	750,000	277,402	.....	..	..	Empire & Bay States Telegraph Co.	100	2,000,000	2,000,000	1 % Q	71	78
*Philadelphia Traction Co.....	50	80,000,000	120,000,000	4 % S—Oct. 1 '97.	82 3/4	82 3/4	*Northwestern Telegraph Co. guar.	50	2,500,000	2,500,000	2 1/2 % Q	117	117
*Catherine & Bainbridge St.....	50	.....	400,000	6 % A—Mar., '97.	185	..	Providence (R. I.) Tel. Co.....	50	.....	.....	.....	87 1/2	..
*Continental Pass. Ry..... guar.	50	1,000,000	580,000	\$6 share—July, '97.	185	..	Southern New Eng. Tel. Co.....	100	8,000,000	.....	.....	120	122
*Empire Passenger Ry. Co.....	50	600,000	600,000	.....	..	..				
*Philadelphia City Pass. Ry.....	50	1,000,000	475,000	\$7.50 share July '97	175 1/2	180							
*Philadelphia & Gray's Fy. RR....	50	1,000,000	298,650	\$8.50 share July '97	86	..							
*Ridge Avenue Passenger Ry.....	50	750,000	420,000	\$12 share, July '97	275	300							
*Philadelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	..	..					
*17th & 19th Sts. Pass. Ry. guar.	50	.....	250,000	1 1/2 % S., July, '97.	157 1/2	..							
*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	835,000	\$11 sh. A., July, '97	270	..							
*Union Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. July, '97	220	228							
*West Philadelphia Pass. Ry.....	50	750,000	750,000	\$10 share, July '97	280	285							
Rochester, N. Y.—May 28:													
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16	18							
Reading, Pa.—May 28:													
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	..							
*City Passenger Ry.....	50	850,000	850,000	Jan., '98.	112	..							
*East Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..							
St. Louis Mo.—May 28:													
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..				
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 % Dec., 1898.	122 1/2	125							
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 % Jan., '98.	..	..					
National Railway Co.....	..	2,500,000	2,479,000	1 1/2 % Jan., '98.	..	..					
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000	.....	90	110							
*Citizens' RR.....	100	2,000,000	1,500,000	4 % Oct., '98.	95	105							
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 % Jan., '98.	170	172 1/2							
Missouri RR.....	50	2,400,000	2,800,000	1 1/2 % Jan., '98.	..	..					
People's RR. Co.....	50	1,000,000	800,000	50c., Dec., '89.	87	90							
Southern Electric Ry..... com.	50	500,000	500,000	.....	57	60							
Southern Electric Ry..... 6 % pref.	100	1,000,000	1,000,000	1 1/2 % Jan., '98.	108	110							
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	53	56							
Union Depot RR.....	100	4,000,000	4,000,000	8 % A., July, '98.	..	175							
San Francisco, Cal.—May.													
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	..	110							
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50							
Market Street Ry.....	100	18,750,000	18,750,000	\$2.50 per share.	52 1/2	53							
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	8 1/2							
Scranton, Pa.—May 28:													
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12							
*Scranton & Carbondale Trac. Co..	100	500,000	500,000	.....	..	18							
*Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	.....	..	..				
Springfield Ill.—May 28:													
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11							
Springfield O.—May 28:													
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2							
Springfield, Mass.—May 28:													
Springfield Street Ry.....	100	1,200,000	1,166,700	8 % A.	205	210							
Toronto Canada.—May 28:													
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	97 1/2	97 1/2							
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4 % S.	258	258 1/2							
Washington, D. C.—May 28:													
Belt Ry. Co.....	50	500,000	500,000	.....	..	..				
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	73 1/2	71 1/2							
Columbia Ry. Co.....	50	400,000	400,000	6 % A.	75	78							
Eckington & Soldiers' Home Ry....	50	707,000	652,000	.....	8	..							
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	119 1/2	120 1/2							
Metropolitan RR. Co.....	50	1,000,000	458,900	2 1/2 % Q.	..	..					
Worcester, Mass.—May 28:													
*Worcester Traction Co..... com.	100	8,000,000	8,000,000	.....	15	17							
*Worcester Traction Co..... 6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	92	94							
Worcester & Suburban Street Ry...	100	550,000	542,500	4 1/2 % 1897.	84	..							
Wilkesbarre, Pa.—May 28:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 % Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidated. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$30,000 p. a. in 1898-1900 and \$80,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10 % guaranteed by Reading Traction Company.
 n Dividend of 6 1/2 % guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—May 28:												
Fort Wayne Electric Co.....	25	.....	.....	.....	..	..	..	..	..	..	..	..
Ft. Wayne Elec. Co. T. Sec. Series A.	100	40,000,000	80,460,000	2 % Q. Aug., 1898.	86 1/2	86 1/2	..	..	..	..	..	..
General Electric Co..... com.	100	10,000,000	4,232,000	8 1/2 % S., July, '98.	90	95	..	..	..	..	..	..
General Electric Co..... pfd.	100	.....	.....	.....	..	..	..	..	..	..	..	..
T.-H. Elec. Co. T. Secur., Series D.	..	.....	.....	.....	22	23	..	..	..	..	..	..
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	82	87	..	..	..	..	..	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1 1/2 % Q., Feb., '98.	62	58	..	..	..	..	..	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,196,128	.....	..	..	..	..	..	..	..	..
New York.—May 28:												
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	128	182	..	..	..	..	..	..
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	8,750,000	1 1/2 % Oct., '97.	108 1/2	107 1/2	..	..	..	..	..	..
Edison Ore Milling Co.....	100	.....	.....	.....	10	18	..	..	..	..	..	..
Edison Electric Storage Co.....	..	.....	.....	.....	..	..	..	..	..	..	..	..
General Electric Co..... com.	100	40,000,000	80,460,000	2 % Q. Aug., 1898.	86 1/2	86 1/2	..	..	..	..	..	..
General Electric Co..... pfd.	100	10,000,000	4,232,000	8 1/2 % S., July, '98.	90	95	..	..	..	..	..	..
Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	..	..	..	..	..	..	..
United Elec. Lt. & Pow. Co..... pfd	..	.....	.....	.....	..	..	..	..	..	..	..	..
Pittsburg, Pa.—May 28:												
Allegheny County Light Co.....	50	500,000	500,000	J. & J.	127	..	..	..	..	..	..	..
East End Electric Light Co.....	100	800,000	800,000	Q	..	10	..	..	..	..	..	..
Philadelphia, Pa.—May 28:												
Edison Electric Light Co.....	100	2,000,000	.....	.....	144	73	..	..	..	..	..	..
*Electric Storage Battery Co.....	100	8,500,000	.....	.....	22	78 1/2	..	..	..	..	..	..
*Electric Storage Battery Co..... pfd.	100	5,000,000	.....	.....	24	29	..	..	..	..	..	..
*Fenna. Ht., Lt. & Pow. Co..... com.	50	5,000,000	.....	.....	..	..	..	..	..	..	..	..
*Fenna. Ht., Lt. & Pow. Co..... pfd.	50	5,000,000	.....	50c. p. sh., Oct. '97.	..	..	..	..	..	..	..	..
Northern Elec. Light & Power Co..	10	8,000,000	.....	6 % Oct., '97.	..	..	..	..	..	..	..	..
Southern Elec. Light & Power Co..	10	6,500,000	580,000	\$82500 dis. Jan. 11 '97	185 1/2	14	..	..	..	..	..	..
	10	187,500	187,500	....	10	..	..	..	..	..	..	..
Miscellaneous.—May 28:												
Brush Electric Co.....	50	.....	.....	.....	87 1/2	40	..	..	..	..	..	..
Bridgeport (Conn.) Elec. Lt. Co.....	25	800,000	.....	.....	18	18	..	..	..	..	..	..
Missouri-Edison (St. Louis)..... com.	..	.....	.....	.....	..	..	..	..	..	..	..	..
Eddy Electric Mfg. Co.....	25	.....	.....	.....	..	18	..	..	..	..	..	..
Hartford (Conn.) Elec. Light Co.....	100	850,000	.....	.....	125	128	..	..	..	..	..	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	.....	.....	6	11	..	..	..	..	..	..
New Haven (Conn.) Elec. Lt. Co.....	100	100,000	.....	.....	160	..	..	..	..	..	..	..
Narragansett (Prov. R. I.) Elec. Co.	50	1,200,000	.....	2 % Q., Oct., '98.	83 1/2	85	..	..	..	..	..	..
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	110	120	..	..	..	..	..	..
Royal Elec. Co. (Montreal).....	100	.....	.....	2 % Q	153 1/2	158	..	..	..	..	..	..
Toronto (Canada) Elec. Light Co..	100	1,000,000	.....	1 1/2 % Q	153 1/2	184	..	..	..	..	..	..
Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	3 % S., Dec. 1, '98.	..	100	..	..	..	..	..	..
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	100	110	..	..	..	..	..	..

Digitized by Google

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—May 23, 1898.						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co. 1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	105	107
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	107
Mount City RR. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co. 1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. 1st mtg. 6s.	2,000,000	1,400,000	1921	F. & A.	100½	101½
St. Louis & Sub. Ry. Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry. 1st mtg. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	108	104
Union Depot RR. Co. Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	118	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$600,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—May, 1898.						
California St. Cable RR. 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co. 1st mtg.	200,000	.....	.....	.....	.....	.....
Omni-bus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR. 1st mtg. 6s.	850,000	850,000	1912	J. & J.	105½	.....
Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Utter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—May 28, 1898.						
Belt Ry. Co. Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Edgington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—May 28, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	100	105
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	110	112
Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1938	M. & N.	79	80
Croswell St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	108
Croswell St. Ry. (Columb.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1938	A. & O.	70	78
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	98
N. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Pecheater (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	.....
St. Paul City Ry. Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of J. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—May 28, 1898.						
Edison Elec. Illuminating Co., Boston.....	2,026,000	.....	1922	Quar.	156	.....
General Electric Co. gold coup. deb. 5s.	10,000,000	8,750,000	.....	.....	104	.....
Pittsburg, Pa.						
Date of Quotation—May 28, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light 1st mtg. 4s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(May 28, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 6s.	4,312,000	4,812,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,166,000	1938	.....	113½	.....
Edison El. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—May 28, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telegraph Co. 1st mtg. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108½	.....
Chesapeake & Potomac Teleph. Co. 1st mtg. 5s.	.....	.....	1911	J. & D.	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—May 28, 1898.						
American Electric Heating.....6s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 6s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 1st mtg. 6s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 1st mtg. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 1st mtg. 6s.	15,000	.....	.....	.....	.....	.....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½c.; Lake, 11½@12c.; casting, 11½c.

The bill giving electric light companies permission to sell gas has been rejected by the Massachusetts Senate by a vote of 13 to 18.

There were two lots of \$155,000 each of the bonds of the General Electric Railway Company of Chicago sold by auction last Wednesday at 25.

The Westinghouse Electric Company has decided to close its glass factories for the season June 1, one month earlier than usual.

The Government has rejected all the bids for furnishing and installing an electric light and power plant at Fort Washington, and new bids will be called for.

The capital stock of the Electrozone Commercial Company, admitted to the unlisted department of the Philadelphia Stock Exchange on Friday last, is \$600,000.

There was a report current in Chicago last week that the City Railway Company had finally succeeded in getting possession of the General Electric Railway franchise.

A blanket mortgage for \$15,000,000, covering the rolling stock and other property of the North Jersey Street Railway Company, has been recorded at the office of the Essex County Register, Newark, N. J.

The Edison Electric Illuminating Company of Brooklyn, N. Y., reports gross earnings for April of \$73,590, an increase of \$5,805 as compared with the same month last year, and net \$31,413, an increase of \$544.

The Worcester & Suburban Street Railway Company of Worcester, Mass., will pay a dividend of \$2 per share on June 10 to stockholders of record June 1. It is reported that the company makes a much more favorable showing this year than at any corresponding period for a number of years.

At the last meeting of the directors of the Metropolitan Railroad Company, Washington, D. C., it was decided to reduce the quarterly dividend from \$1.25 to \$1.20 per share. A director of the company is quoted as saying that the reason for this action was that the company had been under heavy expense recently and it was thought best to economize.

The annual meeting of the stockholders of the International Bell Telephone Company, Limited, was held in New York on Wednesday last. These directors were elected: Samuel D. Babcock, Louis A. Von Hoffman, Richard A. McCurdy, Charlton T. Lewis, Elisha S. Converse, Ferdinand M. Theriot, Howard S. Randall, Louis A. Thebaud and Charles J. Bell.

The street railway investigating commission which it was understood was to examine and report fully the status of the street railroads of Chicago in their relations to the city has decided to take no action in the matter at present, Mayor Harrison having refused to appoint additional members to make the commission so widely representative as to disarm criticism.

The Philadelphia "Times" says: "Stockholders of the Northern Electric Company, which has been taken in by the Pennsylvania Manufacturing, Light & Power Company, are being told that they will receive a cash dividend of about 2½ per cent., and in consequence their subscription privilege on Pennsylvania Manufacturing Company stock will be but 5 per cent. of their holdings, instead of 20 per cent., as at first proposed."

A trust mortgage for \$2,000,000 was filed on the 25th ult. in the Register's office in Brooklyn, N. Y., by the Coney Island & Brooklyn Railroad Company to the Mercantile Trust Co. on property at Smith and Huntington streets and Coney Island avenue and King's Highway, and upon the franchises of the company, to secure an issue of 4 per cent. bonds made necessary by the consolidation agreement with the Brooklyn City & Newtown Railroad Company.

President Uhlman of the Brooklyn Elevated Railroad said a few days ago that in consequence of the continued rainy weather it will be impossible to start the cars across Brooklyn Bridge on June 15, but they would be started just as soon as practicable. He also stated that his company had entered into a contract with the Brooklyn Heights Railroad Company to furnish electric power. It is expected, however, that the "L" road will subsequently have its own electric plant.

Transfer was made at Baltimore on the 23d ult. of the securities issued by the Columbia & Maryland Electric Railway Company, on the Baltimore & Washington Railroad line, amounting to about \$425,000, purchased by Nicholas P. Bond of Baltimore, Scott & Co. of Wilmington, Del., and their associates. John E. Searles, secretary of the American Sugar Company, who, with Mr. Bond and Mr. Scott, indorsed the notes given by the Baltimore Trading & Security Company, will not be identified with the new company.

The annual report of the Boston Electric Light Company, covering operations for the fiscal year ending June 30 next, will show earnings, after interest charges, equivalent to about 13 per cent. on the 25,000 shares capital. The company is at present paying 6 per cent. dividends. On the basis of present selling price for land on Summer street, Boston, near the new station, the company's property there is worth \$1,800,000. This property stands on its books at a valuation of less than \$400,000, which is equivalent to a profit of about \$1,500,000, or \$60 per share.

The Trenton, N. J., "Gazette" of the 23d ult. says: "Deputy Marshall Bower of the United States Circuit Court is serving summonses in the case of Augustus Ireland, of New York, against the Trenton Light & Power Company, Hugh H. Hamill as trustee, and the Trenton Banking Company and others to discover the whereabouts of about 600 shares of the Trenton Light & Power Company stock which were sold by Sheriff Ashmore as the property of Frank A. Magowan. These shares were sold subject to claims on them. Mr. Ireland, who has an interest in them, says he has to resort to the courts to learn where the stock is, as Magowan will not give him any information."

Judge Barnard, in Poughkeepsie, has enjoined temporarily the majority stockholders of the Kings County Traction Company, Brooklyn, N. Y., from disposing of the assets of the company or proceeding for a voluntary dissolution pending the trial of an action by the Attorney General to prevent the dissolution. Judge Barnard says that the present conditions should continue until the trial, as the company held very valuable property, which was broken up unwisely and not advantageously to the owners of the stock. The cause is to go to trial at the next Equity Term in Queens County, the plaintiff to have the right to move to vacate the injunction if the plaintiff fails to try the cause when reached, or before, if the Judge, in view of the great interests involved, should advance the trial.

The Washington, D. C., "Times" says: "The burning of the central cable power house of the Capital Traction Company in September last, which caused that company to install the underground electric system, has proven to be of immense financial benefit to its stockholders. In anticipation of the earnings that it was estimated would result from the installation of this system, its stock has already advanced from \$45 to \$74 per share, and it is now predicted that it will advance to par, as the earnings of the road justify the payment of a 1 per cent. dividend in July, notwithstanding the fact that the new system has been in operation on the avenue for only a month and has not yet been installed on the Seventh Street line. When the road is fully equipped with the new system it is estimated that the earnings will be sufficient to pay a 1½ per cent. dividend, equal to an annual dividend of 5 per cent., which will certainly be welcome news to the many stockholders who paid par or thereabouts for their stock and who saw it drop speedily to 50 and less with grave concern."

ELECTRICITY.

Vol. XIV.

NEW YORK, JUNE 8, 1898.

No. 22.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	iv
Classified List of Advertisements,	viii
Editorial Notes,	337-338
Another Important Patent Decision.	
Incandescent Lamps.	
The National Electric Light Convention.	
Electric Light in Italy.	
Under the Searchlight,	338
The Twenty-first Convention of the N. E. L. Association,	339
Shoreditch Destructor Plant,	340
Opening of the Trans-Mississippi and International Exposition,	340
Obituary—Charles E. Emery,	340
Electrical Exhibition,	340
The Prevention of Interruptions to Electricity Supply. By Leonard Andrews,	341
The Electro-Chemical Industries of England. Article II. By J. B. C. Kershaw, F. I. C.,	344
The Temperature of Incandescent Lamps,	345
Legal Notes,	346
The News,	346
Lighting Plants—Street Railways—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Commercial Paragraphs,	347
Incorporations,	348
Electrical Patent Record,	348
Telephone and Telegraph,	348
Electrical Securities—Stocks, Bonds, Etc.,	349
Notes for Investors,	352

EDITORIAL NOTES.

Another Important Patent Decision. The Sprague Electric Railway and Motor Company has just won a decision in a long-drawn-out lawsuit against the Union Railroad Company, better known as the "Huckleberry" Road, and the Walker Company, restraining the latter from either using or selling the Sprague electric railway motor. The decision rendered by Judge Wheeler of the United States District Court, in which the Court of Appeals now concurs, orders that the defendants be perpetually enjoined from making, using, or selling the device. It also directs that the defendants pay to the plaintiff all profits which they have derived from the infringement and the use of the Sprague motor, the original inventor of which was Mr. Frank J. Sprague. Commissioner Shields is designated as master to take an account of such profits and to report to the court. This decree is final and ends this long-drawn-out suit, which has been considered and passed upon by nearly every United States Judge in this District, unless the defendants decide to carry the litigation to the United States Supreme Court.

* * *

Incandescent Lamps.

Probably strictly speaking the first incandescent lamp was invented in 1841 by Frederick de Molyens of Cheltenham, England. This lamp, which was only valuable as marking the beginning of a new era in lighting, was constructed on the principle of the incandescence produced by the high resistance of a platinum wire to the passage of an electric current. Some four years later, J. W. Starr of Cincinnati suggested the use of carbon as a filament, and produced an incandescent lamp having twenty-six lights which was widely talked of at the time, even attracting the attention of Faraday. A number of other incandescent lamps were brought out about this time or within a few years, although no substantial progress was made in the way of commercial incandescent lighting until the dynamo made its appearance, many years later. It was very soon discovered, when it became a question of practical lighting, that filaments of platinum would not answer the purpose as they rapidly deteriorated in the air, finally breaking, owing to the action of oxygen on their surfaces. Scientists then abandoned platinum, after attempting in every possible way to get satisfactory results, and sought to discover some other substance which would not deteriorate by oxidation when heated. Carbon was thought of, the superiority of which as an illuminant having already been demonstrated, its principal objection however being the rapidity with which it was consumed. It

was therefore necessary to devise some means of retarding the consumption. This it was thought could be accomplished by excluding the oxygen from the vicinity of the carbon filament while hot. An attempt was made to solve the problem by filling the globe in which the filament was located with nitrogen, endeavoring in this way to eliminate the oxygen, at the same time maintaining a pressure in the globe equal to that of the atmosphere, which was thought necessary to ensure good illumination. This method, although it attracted considerable attention at one time, was not sufficiently satisfactory for practical purposes. The invention of the mercurial air pump made it possible to obtain what heretofore had been extremely difficult, namely, an almost perfect vacuum. The difficulty of introducing the current into the globe containing the filament was then overcome by imbedding an extremely fine platinum wire in the glass, thus connecting the enclosed carbon with the external circuit.

The next point of greatest importance was the obtaining of carbons of the proper consistency, tenacity and durability. Brown paper and cardboard cut into narrow strips were finally tried. These were reduced to carbon by being placed in an iron mold in which a high temperature was maintained. Carbon filaments made in the above manner were exceedingly fragile and short lived. Bamboo fiber was then tried. The thin threads were carefully stripped from the surrounding material and were carbonized by being placed between two grooved plates of graphite and subjected to an intense heat for several hours. The filaments obtained in this way are then attached to their wire supports and introduced into the glass bulbs. While the air is being exhausted an intermittent electric current is passed through the filament, causing it to become alternately heated and cooled. The object of so doing is to remove all the occluded gases which remain after the carbonizing, and furthermore to render the carbon homogeneous and elastic. Filaments of carbonized bamboo are used very extensively at the present day. The weakness of the substance, however, is its structure, and moreover it is an extremely difficult matter to obtain the carbonized fiber uniform in cross section. These objectionable features have led to other materials and methods being tried. A filament made of cotton treated with nitric and sulphuric acids, reducing it to nitro-cellulose, then mixed with alcohol and ether and subsequently having its combustibility reduced by the action of ammonium hydro-sulphide, has been used with excellent results. This product is an amorphous cellulose of great durability, tenacity and homogeneity. It is rolled into sheets, filaments of the desired size being then cut off and carbonized in the usual manner. Silk, both natural and artificial, has been tried and is still being made use

of by certain manufacturers. A form of incandescent lamp has very recently been perfected abroad in which the inventor, instead of making use of a carbon filament, utilizes magnesium oxide. Whether this new form of filament will prove more satisfactory than those now generally in use remains to be seen.

* * *

The National Electric Light Convention.

The Twenty-third Convention of the National Electric Light Association, to be held in Chicago on June 7, 8 and 9, will undoubtedly prove most enjoyable and instructive. No pains have been spared by the committee having the arrangements in charge to make the Convention the most notable yet held, and everything points to a realization of their desires. Elsewhere in this issue will be found a detailed description of the arrangements that have been made for the comfort and enjoyment of the visitors as well as the programme showing what papers will be read and topics discussed. An agreeable feature of the Convention will be the large number of ladies present. The entertainment committee having been assured of a numerous attendance of the fair sex, have taken special care to provide suitably for their comfort and entertainment while the gentlemen of the party are discussing intricate problems in the Convention hall. A feature which should prove most enjoyable is the proposed sail on the lake, which will probably take place on Tuesday evening, a band of music and refreshments having been provided for the trip.

The papers to be read and topics which it is proposed to discuss, as can readily be seen, are almost without exception of an extremely practical nature, which is much to be desired. The tendency in the National Electric Light Association to-day would seem to be towards a progressive organization which will ultimately exert a strong influence as an educational medium, and it is to be hoped that the careful selection of the papers to be read and topics to be discussed at the Chicago meeting will serve as a precedent for future gatherings.

* * *

Electric Light in Italy.

Italy is said to be fast appreciating the advantages of the electric light. This is in part due to the fact that the price of petroleum, which has heretofore been extensively used for illuminating purposes, has been forced up by restrictions and protective duties. Most all the theaters, many of the streets and the principal shops and offices are now lighted by electricity. This form of illumination is extremely acceptable owing to its cleanliness and convenience, and to the fact that it does not perceptibly heat a room, which is much to be desired in a comparatively warm climate such as that of Italy. Wherever water power is available, advantage has been taken of it for generating current for illuminating purposes. The thriving town of Capua is lighted by energy obtained from the river Volturno, and Cava dei Tirreni, also an important town, derives its power from the machinery of a large mill, driven partly by water and partly by steam, which grinds corn during the day and illuminates the town at night.

There are many other centers of population in Italy that have made good use of water power for the purpose of operating electric lighting plants, or that contemplate so doing. The town of Amalfi, which is a favorite resort of travelers in the winter season owing to the salubriousness of its climate, has a swift stream of water running through it which is utilized for operating numerous paper mills as well as several large factories. To install an electric lighting plant there, as proposed, would be neither costly nor difficult, and that it would pay to do so cannot be doubted, as it is claimed the large hotels alone would ensure remunerative returns.

Naples is now illuminated by electricity and is

supplied with a continuous current of 110 volts. The lamps most generally used are of German manufacture, either the Schubert or those turned out by the Allgemeine Elektrizitäts Gesellschaft; lamps very inferior in color of globes, finish and illuminating power to those manufactured in this country. In view of this fact and the general conditions existing in Italy, there seem to be excellent opportunities for the introduction of American lamps and other electrical apparatus. During the last fiscal year this country exported but \$86,281 worth of electrical machinery to Italy, which can scarcely be said to compare very favorably with the \$298,000 worth exported that same year to France, or even to \$168,864 which represents the amount exported to Belgium. We have noticed, however, that several contracts for electrical installations in Italy have of late been awarded to American manufacturers, and it would not be surprising therefore if the amount of electrical exports to Italy this present year much exceeds that of last in spite of our war with Spain.

Under the Searchlight.

Notes and Comments on Various Topics.

AN electrical exhibition similar in some respects to that which has just closed at Madison Square Garden is now in progress in Philadelphia.

* * *

THE report that Capt. Coffin, president of the G. E. Company, had an inclination to follow his first vice and other patriotic members of the company into the war, but that finding all the fat places in the commissary and quartermaster departments were already filled, and that in any line position he was likely to get there was a possibility of his sudden taking off by a Spanish bullet, unshriven and unprepared, he dismissed the intrusive thought. His conclusion probably was, that—

While dynamos and motors sell, and lamps hold out to burn,
Escape is possible from—well, the vilest sinner may return.

* * *

THIEVING has lately taken a new departure which may result in serious consequences if not nipped in the bud. It has lately dawned on a thievish gang of boys in New Jersey that the copper and zinc to be found in most electric batteries are marketable commodities, and as a result they have recently been relieving the electric batteries which furnish the current to the signaling apparatus on the Central Railroad of these essential metals. Serious accidents from the weakened batteries are said to have only been avoided by the watchfulness of the tower-men.

* * *

APPARENTLY the General Electric Company, not content with working its stockjobbing schemes in this country, or possibly awakening to the fact that its methods are becoming very generally known here, is about to branch out and begin operations in Central America. This company is now said to be connected with a movement in London to take charge of Costa Rica or of the cities and towns thereof for the purpose of putting in lighting plants and electric railways. San Jose, it is said, has been selected as the first point of attack.

* * *

THE latest fad among society women is to have some member of the body photographed by X-rays. They like particularly to have their hands X-rayed, with all the bones clearly defined, outlined with a faint penumbra which represents flesh, while the rings and bracelets stand out in black relief. One woman not satisfied with exhibiting the beauty of

the bones in her hand, has had her whole body X-rayed, and the full-sized bone portrait has been on exhibition at the Electrical Exhibition during the past two weeks. Comments on the thing varied according to the impressions of the spectators, but the consensus of opinion was that such displays are more repulsive than edifying.

* * *

THE Rev. F. F. Jernegan's process for extracting gold from the sea has again been heard from. This process, which is said to have been the result of a vision, is controlled by what is termed the Electric Marine Salts Company, whose present field of operation is at or near North Lubec, Me. This plant, by the force of electricity and the use of a "certain chemical," it is now claimed extracts gold and silver from the ocean at a net profit of \$100 a day. This alleged excellent showing should certainly be inducement enough for many of the simple-minded Puritans of New England to purchase stock, of which, of course, very little is to be had. This scheme, however, should, we think, be classed in the same category with the Electropoise, electric combs for turning hair from white to black, and with electric shoes which a firm in England has recently brought out.

* * *

IN a certain punctilious suburb, says the New York Evening Sun, they have recently set up a code of "telephone etiquette." Any one who has enjoyed the domesticated telephone knows the grievous uncertainty attached to such problems as, who shall ring off first, she who has been called up or she who has done the calling? What is the best form of greeting through the telephone? And in announcing one's self, is it proper to give the Christian name or the prefix Miss or Mrs.? All these and similar vexed questions the book of telephone etiquette assumes to answer satisfactorily. According to its code, the proper telephonic salutation when the caller-up is a man is "Hello!" When the caller-up is a woman it should be "Hallee!" In this way the sex of the inquiring individual is at once made clear. The prefix to the name should always be given, says the etiquette book. Remember that Central and crossed wires supply many opportunities for others hearing your conversation, and that to most such you are a woman with a prefix. It is treating them to too much familiarity to boldly belittle forth your Christian name. The etiquette book is very severe upon those who commit conversations of personal and private nature to the tender mercies of the telephone wires. Gossip it taboos in particular, though it admits that much of the spice of suburban society would be removed if this rule was followed. It is telephonic bad form for two women who do not visit to consult each other upon any matter over the wires. If they don't call they have no right to "call up." Several methods of terminating a telephonic interview are given, among others: "Well, I guess I'll say goodbye now—hm-m-m," "Well, my dear, I won't trouble you any longer: goodbye—hm-m-m," and "So sorry to have bothered you, but—hm-m-m," the indefiniteness of the final words being the artistic and inexorable point. The happy diplomacy of getting rid of an unwelcome telephonic guest by pretending that some person or something demands your attention elsewhere is not encouraged by the etiquette book, and is only to be resorted to in extreme cases. In all homes of the suburb, where the need of a code to define what was good and bad form over the telephone first made itself felt, the etiquette book hangs right beside the list of subscribers, and is not less used. "Still," observed a man on glancing through the book the other day, "I notice that it says nothing about the good or bad form of the things you say when you ring up a certain number twenty times, and are each time told that it's busy."

THE TWENTY-FIRST CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The Twenty-first Convention of the National Electric Light Association, which is to be held in Chicago on June 7, 8 and 9, and which unquestionably is the most important event of the year in electrical circles, should prove of great value from a technical standpoint as well as a most enjoyable social gathering. The papers to be read and topics that will be discussed at this meeting are of supreme importance, and owing to the presence of a large number of experts thoroughly conversant with these subjects, many knotty questions should be solved and much valuable information furnished to the electrical industry in general and the electric lighting field in particular.

tain the visiting members and unquestionably afford them a good time, without however interfering with the work of the Convention. As most of the Eastern delegates will arrive in Chicago on Monday, the 6th, it is proposed to hold an informal reception at the Association's headquarters in the Auditorium on the same evening, which will last from 8:30 to 10 P.M., with a view to having the visiting members meet and become acquainted with the local central station men and representatives of kindred industries. There will be music, and light refreshments will be served, and this informal gathering should go far toward breaking the ice and making the more formal meetings to be held on the following days all the more enjoyable.

Mr. Samuel Insull, who has so ably filled the position of President of the Association during the past year, has on behalf of the Chicago Edison Company, of which he is also president, extended a general

The ladies of the party, a large number of whom are expected, will be well cared for by the Committee on Arrangements, and in order that time shall not hang heavy on their hands while the Convention is in session, it is proposed to give two tally-ho parties, one on Tuesday through the South Park system, to be followed by a luncheon, and another on Wednesday which will take in the North Shore drive, Lincoln Park and the Sheridan drive. Providing the weather is not inclement, the party may go through Buena Park and even as far north as Evanston. It is thought that these coaching parties will prove very attractive and enjoyable.

The official programme of the Convention is as follows:

TUESDAY, JUNE 7.

Meeting of the Executive Committee at 9 A.M., Secretary's office, Auditorium Hotel.



AUDITORIUM HOTEL, CHICAGO, WHERE THE NATIONAL ELECTRIC LIGHT CONVENTION WILL BE HELD.

The final arrangements for holding the Convention have all been completed, and, thanks to the energy of the gentlemen having charge of these matters, the success of the gathering is assured. As we stated some time ago, the headquarters of the Association will be at the spacious and commodious Auditorium Hotel, which is beautifully situated, overlooking as it does the waters of the lake, and moreover has the advantage of being centrally located. The preparations that have been made for the reception and entertainment of the members are on a most elaborate scale. A committee of twenty-five has been appointed to act as a reception committee, composed of representatives of leading electrical interests in Chicago. These gentlemen will receive and enter-

invitation to manufacturers and agents having apparatus and supplies of any description in use in the Edison system to invite friends to inspect these products in actual operation. The Western Electric Company will also extend an invitation to members of the Association and other visitors to inspect their extensive factory during the Convention week, and the Chicago Telephone Company has placed the company's service at the disposal of the members of the Association during the Convention.

An extremely enjoyable feature of the Convention will be a ride on the lake, Tuesday evening having been selected for this entertainment. A steamer will be chartered and arrangements made for music. Refreshments will also be served during the trip.

Morning Session, 10:30 o'clock, Convention Hall, Auditorium Hotel.

Address of President Insull.

Paper—Calvin W. Rice, Brooklyn, N. Y. "Cost of the Generation and Distribution of a Unit of Electricity."

Topic—"Prices and Discounts for Electric Current and Methods of Billing Current to Customers."

Afternoon Session, 2 o'clock.

Paper—Alex. Dow, Detroit, Mich. "Public Lighting with Relation to Public Ownership or Control."

Topic—"Legislative Policy as to Public Service Corporations."

WEDNESDAY, JUNE 8.

Morning Session, 10 o'clock.

Paper—Herbert A. Wagner, St. Louis, Mo. "General Distribution from Central Stations by Alternating Currents."

Paper—Louis A. Ferguson, Chicago, Ill. "General Distribution from Central Stations by Direct Currents."

Topic—"Standardizing Apparatus for Central Station Use."

Afternoon Session, 2:30 o'clock.

Paper—W. McLea Walbank, Montreal, Canada. "Cost of Producing Electric Power by Water Power from Lachine Rapids, Canada."

Report of Committee on Standard Candle Power of Incandescent Lamps; Dr. Louis Bell, chairman.



SAMUEL INSULL,
President National Electric Light Association.

Questions and Answers—What is it you wish to know?

Executive session.

Evening Session, 8 o'clock.

Lecture—Joseph Wetzel, New York. "Electricity Direct from Coal" (illustrated with stereopticon).

THURSDAY, JUNE 9.

Morning Session, 10 o'clock.

Paper—Prof. Winder Elwell Goldsborough, Purdue University, Lafayette, Ind. "Transformer Economy."

Report of Committee on Amendments to Freight Classification; James I. Ayer, chairman.

Report of Committee on Legislation Concerning Theft of Current; James I. Ayer, chairman.

Afternoon Session, 2:30 o'clock.

Topic—"Freight Rates on Electrical Apparatus."

Report of Committee on Finance; John A. Seeley, chairman.

Executive session.

Election of officers.

President Insull, while in this city recently, stated that he expected an unusually large attendance, especially of central station managers. With the important papers which are to be read, there is little doubt but what the programme as outlined above will attract many practical men who will be anxious to participate in the discussions.

Shoreditch Destructor Plant.

At a recent meeting held in the Shoreditch Vestry, London, Mr. H. E. Kershaw congratulated the Electric Light Committee upon the success of the Shoreditch Destructor plant. During a period of nine months the total profits reached \$21,320, which, it is claimed, would be equivalent to a dividend of 6½ percent.

OPENING OF THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.

The Trans-Mississippi and International Exposition at Omaha, Neb., was formally opened shortly after 1 o'clock on June 1 by President McKinley amid the music of 50 bands and the cheering of 100,000 persons. Early in the morning on the day of the opening, special trains from all sections of the country began to unload their crowds, who, mingling with the citizens of Omaha, lined the route of the parade for ten miles. At 9:30 the great civic parade started from the center of the city toward the Exposition grounds, with the Marine Band from Washington in the lead. This parade was three miles long, being made up of the Exposition officials and their guests, city and State officials of Nebraska, Iowa, Illinois, Missouri, Kansas and Colorado, the civil and military societies and a large number of handsomely decorated floats. Upon the procession's arrival at the Court of Honor, and at a preconcerted signal given by Mr. G. W. Wattles, President of the Exposition, all the bands played "America" in concert. The Rev. Dr. Samuel J. Nichols of St. Louis then delivered the opening prayer, which was followed by short addresses by President Wattles, Mr. John N. Baldwin of Council Bluffs and Mr. John L. Webster of Omaha. The ceremonies at Washington were brief. Members of the Nebraska delegation in Congress assembled at the White House, accompanied by the ladies of their families, and were presented to the President by Representative Mercer. Some difficulty was at first experienced in getting a clear wire to Omaha, but shortly before 2 o'clock everything was in readiness and the President pressed the button which set in motion the machinery 1,500 miles away. The Nebraska delegation then withdrew and joined in a congratulatory telegram to the President of the Exposition.

President McKinley's telegram of congratulation, addressed to the Hon. G. W. Wattles, was as follows:

"The cordiality of the invitation extended to me to be present at the opening of your great Exposition is deeply appreciated, and I more deeply regret that public duties prevent me from leaving the capital at this time.

"The events of the memorable half century which the Trans-Mississippi and International Exposition commemorates are interwoven with the history of the whole nation and are of surpassing importance. The mighty West affords most striking evidences of the splendid achievements and possibilities of our people. It is a matchless tribute to the energy and endurance of the pioneer, while its vast agricultural development, its progress in manufactures, its advancement in the arts and sciences and in all departments of education and endeavor, have been inestimable contributions to the civilization and wealth of the world.

"Nowhere have the unconquerable determination, self-reliant strength and sturdy manhood of our American citizenship been more forcibly illustrated. In peace or in war the men and women of the West have ever been in the vanguard.

"I congratulate the management upon its magnificent enterprise, and assure all who participate in this undertaking of the deep interest which the Government has in its success."

The Exposition which has just been opened so auspiciously promises to be one of the most attractive ever held in this country. The electrical features especially have been given most careful attention and the Grand Court and Lagoon will be nightly illuminated by some 10,000 16 cp. incandescent lamps. These are clustered upon columns, 154 in number, located about thirty feet apart. The edifices are extremely handsome, especially the Machinery and Electricity building. The Lagoon and electric fountain, "Nautilus," will constantly be played upon by the rays from a number of search-

lights, which should add much to the beauty of the general illumination.

The electrical exhibits are numerous and are representative of the progress made in every branch of the industry.

OBITUARY.

Charles E. Emery.

We regret to have to announce the decease of Mr. Charles Edward Emery, who died on the morning of June 1, after a short illness, at his residence, 370 Gates avenue, Brooklyn. Mr. Emery was well known in electrical circles and was an active and prominent member of the American Institute of Electrical Engineers. He was born in Aurora, N. Y., and in 1861 entered the United States Navy as third assistant engineer and was assigned to the warship Richmond. He served under Farragut in all the operations on the Mississippi, and in 1862 was promoted to the position of second assistant engineer and participated in the blockade of Charleston. On his retirement from the Navy in 1867 he was made consulting engineer and for a time had charge of the construction of war vessels.

Mr. Emery was a high authority on electrical and mechanical subjects, frequently reading papers of importance before the American Institute of Electrical Engineers and other scientific bodies. Ten years ago he was awarded the Tilford prize for reading the best paper before the British Society of Electrical Engineers. Of late Mr. Emery has been practising as an electrical expert, with offices in the Bennett Building on Nassau street, New York. By the death of Mr. Emery the electrical profession loses a highly valued and esteemed member whose ability every one respected. He leaves a widow and a son to mourn his loss.

ELECTRICAL EXHIBITION.

The Electrical Exhibition, which has attracted thousands of persons to Madison Square Garden during the past few weeks, has now drawn to a close with satisfaction to every one concerned—managers, exhibitors and visitors. During the past week probably the greatest interest was centered in the Moore chapel. An Edison phonograph was recently placed at the altar by Messrs. William Edison and E. M. Smiles which repeats the Lord's Prayer, a Psalm and the Beatitudes. On Wednesday evening a marriage was consummated in this chapel, in the presence of a select audience, between Miss Jennie S. Gilmour of Brooklyn and Mr. Charles S. Merten, an electrician, of New York. The ceremony was according to the Presbyterian form, and the beautiful subdued light diffused from the vacuum tubes made the scene impressive and strange. With a view to making the wedding thoroughly electrical the bridal party drove over from Brooklyn in an electric automobile and returned by the same means. The music was furnished by the Edison phonograph. Next to the electrical wedding the theatrophone has probably been the greatest attraction. On Monday night a concert by the well-known Lauder Orchestra, which was being given in the Palm Garden at Milwaukee, was transmitted over the wire a distance of a thousand miles and plainly heard by a large number of auditors. Other long distance musical transmissions were effected with equal success. The many special features of interest which we have described in detail at various times during the past month continued to attract general attention while the Exhibition remained open.

The New York Electrical Exhibition of 1898 will long be remembered as probably the best show of the kind ever held in this country. The success of the Exhibition was unquestionably due to the good judgment, tact and untiring energy of Mr. C. O. Baker, Jr., president of the company, and Mr. Marcus Nathan, the general manager.

THE PREVENTION OF INTERRUPTIONS TO ELECTRICITY SUPPLY.*

BY LEONARD ANDREWS.

It is probable that some central station engineers will remark, on reading the title of this paper, that it is several years behind the times; that interruptions to the supply from a properly equipped modern station never now occur; that at their own particular stations the supply has never once been interrupted since it was started, etc.

It speaks volumes for the progress of electrical engineering during the past few years that there are several existing central stations that can show an absolutely clean sheet in this respect since their commencement, and everyone will agree that their engineers hold a very enviable position. It is very doubtful, however, if any one of them can say that they have not a consumer connected to their mains who has during the past 12 months ever had his supply disconnected; and, if that is so, surely there is still sufficient room for improvement to make the matter worth discussing. After all, it is these local interruptions that are so irritating to consumers. Our experience has been that we get far more abuse from a consumer whose lights fail when his neighbor's lights are burning satisfactorily than we do if they are both suffering together.

Some of the engineers who have achieved such an excellent record attribute their immunity from failures to the fact that they use fuses made of copper of the same sectional area as the mains. There can be no doubt that a large majority of the interruptions that do occur are caused by fuses blowing when they have no business to do so. Yet it does seem rather risky to use no safety devices at all. We have already heard of more than one case where an arc of a few thousand horse power has been started under the pavement, and would not be quieted until the supply had been switched off from the works. On the other hand, when one remembers upon what a number of fuses the continuity of an average consumer's supply is dependent, it is really wonderful that he is not more often left in darkness. It is no exaggeration to say that there are often from 15 to 20 fuses between the generators and the lamps they supply. Is it, then, to be wondered at that we are so often told that electricity supply is not to be relied upon? It would be different if we could always depend upon fuses blowing at approximately the current they are set for. But we cannot. It is no uncommon case to take two similar fuses that have been in use for some months and find that one requires about 100 per cent. more current to blow it than does the other. The fuses used on alternate-current circuits appear to be particularly erratic in this respect.

The London Electrical Review drew attention to this fuse trouble in one of its leading articles a few months ago. Still more recently, Mr. W. B. Sayers, in an article in *Lightning* on the subject, says:

"In a city less than 100 miles from where I live there is an electricity works which, so far as I am aware, has not failed to maintain its supply for a single minute during the last four or five years; and yet the popular belief that the 'electric light is not reliable' is maintained to this day, and with good reason. . . . Now the only proper cause, in my opinion, for a main fuse 'blowing' is a short-circuit on the mains, and yet I have no hesitation in saying that less than 1 per cent. of the cases of main fuses 'blowing' are due to this cause."

The conclusion that we have come to at Hastings is that the only reliable conductor of electricity appears to be a copper cable; and, consequently, it seems advisable to reduce all fuses, switches, safety devices, and mechanical connections of any description to a minimum.

If any fuses that it is customary to use can be

omitted, every one will admit that they are a source of danger, and, consequently, better omitted. Take, for instance, the fuses between alternate-current generators and the bus-bars: what are they used for? They cannot be necessary to protect the machines from being overloaded, because all modern makers claim that their machines may be short-circuited with impunity. Presumably they are intended to prevent a generator that fails short-circuiting other machines working in parallel with it; but everyone knows that if two or three machines of an equal output, and equally fused, are working together, it would be the fuses of the healthy generator that would blow, and not those of the faulty

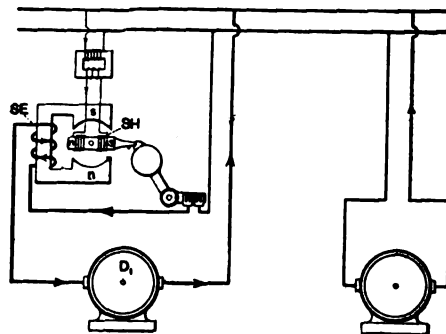


FIG. 1.

one, because the former have to carry sufficient current to blow the latter, in addition to all the useful work on the mains at the time.

Now what should we think of an omnibus driver who cut the traces of one of his horses because it attempted to do more than its share of the work, or who, when one of them fell down dead, made the remaining horse drag the dead one along in addition to the extra work thrown upon it by the decease of its comrade? This sounds absurd, but it practically represents the manner in which we alternate current station engineers have been educated to treat our machines; for are we not taught carefully to equip them with safety devices to cut them out of circuit just at the time when all their energies are required to burn out a short-circuit on the mains, whereas any device to prevent a failing machine from short-circuiting others is considered quite an unnecessary piece of apparatus?

In continuous-current stations zero out-outs, or

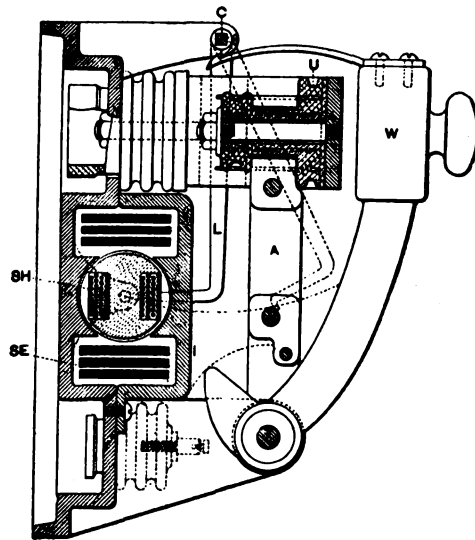


FIG. 2.

discriminating out-outs, are generally used in preference to excess-current out-outs—the word "discriminating" being used to designate a out-out that operates only when the current is flowing through it in a reverse direction to its normal.

Magnetic out-outs of any description have not hitherto been looked upon with much favor in this country. The majority of those now in use require too careful and delicate treatment to be popular. Only people who have attempted to design a simple

and trustworthy discriminating out-out can realize the number of difficulties that have to be overcome in doing so. It is easy enough to make an apparatus that will operate under certain specific conditions in the workshops, but it is a very different matter to construct a out-out that can be relied upon to open the circuit of a failing generator with a very small return current, and that can be guaranteed never accidentally to operate at any time when it is not required to do so. In the first place, the sectional area of the winding must be large enough to carry the maximum current of the generator without undue heating; at the same time the apparatus must be small and compact, consequently the turns must be few; and, finally, it must operate with a return current of only a small percentage of the maximum current, therefore the ampere-turns or magnetizing force must be small. This generally involves the use of delicate releasing mechanism or relays, which require careful treatment, or they will operate at the wrong time, and not when a failure occurs. These are only workshop difficulties. The more serious are those which confront us when the apparatus is in use under actual working conditions.

Take, for instance, the case of zero magnetic out-outs. Everyone knows that these can be made to operate only when the current falls below a predetermined amount; and yet it is also well known that if a short-circuit occur on a system of mains supplied by a number of generators equipped with zero out-outs, several of the generators will be promptly cut out of circuit. This is simply a specimen of the many troubles which it is impossible to foresee and guard against in the manufacturer's workshop.

Between three and four years ago we realized that a reliable discriminating out-out was badly wanted, and since that time considerably over 100 different combinations of compound windings and releasing mechanisms have been experimented with. Many of these have only reached the experimental stage, but a fair proportion have had several months' actual use under working conditions before some unforeseen difficulty made it necessary to scrap them for some new and improved arrangement. The result has been that we have at last been able to secure a out-out that appears to be perfect.

It appears at first sight impossible to design a satisfactory discriminating out-out for use in connection with alternate-current machines in which the current is reversing in direction some thousand times a minute. So long as one considers these reversals in relation to a constant polarity, it is, of course, impossible; but as soon as the direction of the current through a particular machine is considered relatively to the direction of the current in all other parts of the system, the problem becomes a comparatively simple one. Fig. 1 illustrates diagrammatically what we have found to be the most satisfactory method of applying this principle. The operating device in this arrangement is practically a shunt-wound motor, the thick winding of which is connected in series with one of the leads from the alternator it is intended to control, and the shunt winding is connected across any transformer excited off the bus-bars. Now it is obvious that the direction of the current in the shunt winding, SH, will pulsate synchronously with the current in the bus-bars, and will be quite independent of the direction of the current in the series winding, SE, whereas the direction of the current in the latter relatively to the current in the bus-bars will depend upon whether the machine to which it is connected is generating current or is being driven as a motor. If both machines are generating current, then the direction of the current throughout the whole system at a given moment will be represented by the arrow-heads shown full. But if, say, alternator D₁ fails, it will tend to short-circuit the rest of the system, and the current will rush back into it in the direction shown by the dotted arrow-heads, whereas

* Paper read before the Institution of Electrical Engineers, London, Eng., May 5, 1908.

the direction of the current in the other circuits will remain the same. In the former case the relative direction of the shunt winding to the series winding in the out-out device will be such as to tend to make the armature rotate in a clock-wise direction, and so to lock the switch securely; but when, as in the latter case, the direction of the series current relatively to the shunt current is reversed, the arma-

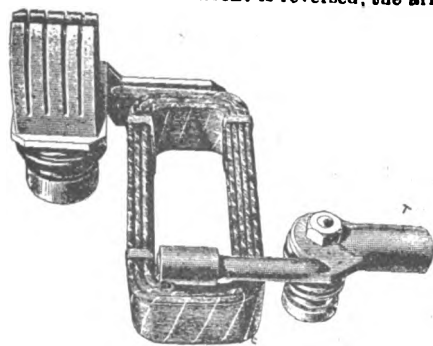


FIG. 3.

ture will rotate in a contra-clockwise direction, and so open the circuit.

Fig. 2 is a sectional elevation of a mechanical application of this principle to a low-tension out-out suitable for use with continuous-current generators, transformers and low-tension mains. The weight, W, is held in a nearly vertical position by the catch, C. Attached to the catch is a lever, L, the free end of which engages in a pin projecting from a metal disk on the end of the armature, S H. The series winding, S E, consists of a few turns of thick copper tape wound directly around the armature. One end of this is sweated and riveted directly on to a brass plate screwed and sweated to one of the contacts, and the other end is sweated on to a thimble, T (Fig. 3), which forms one of the series terminals. The other series terminal is screwed and sweated directly on to the second contact. The whole of the series connections and contacts are supported on three corrugated porcelain insulators sulphured into the base. Fig. 3 shows these series connections removed from the rest of the out-out. This series winding encloses a practically closed double magnetic circuit consisting of the armature core, a portion of the base, and the cast-iron covers. For alternate-current working these parts are, of course, laminated.

An important feature of this out-out is the releasing catch. This is shown in detail in Fig. 4. The pin, P, is fixed in such a position on the armature

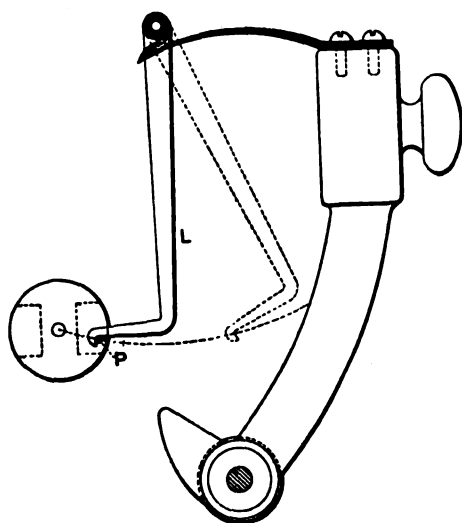


FIG. 4.

disk that an extension of the arc described by the lever, L, will cut the pin P and the center of the armature disk. The result of this arrangement is that no amount of vibration or pressure applied to the weight W will tend to make the disk rotate in either direction. And consequently when the armature is rotated by a return current it releases the

weight without having first to lift it, as it would have to do with any other form of catch. We find this an absolutely reliable and extremely sensitive form of release.

When the weight W is released it falls through an angle of about 60 degrees, then with a sharp blow it strikes the arm carrying the contact connecting piece, thus overcoming any sticking of the contacts due to a good fit or to corrosion.

A specimen of 500-ampere out-out of this description is shown on the table. You will see that it is so reliable that, even when there is no forward current on to lock it in position, it may be knocked about with a mallet to show that no amount of vibration will release it, whereas it is so sensitive that the pressure of a feather upon the armature will do so.

The same general arrangement without any winding on the armature makes a very sensitive and reliable excess-current out-out.

Fig. 5 is a sectional elevation of a similar out-out modified for use in connection with high-tension currents. In this arrangement the contacts are screwed and sweated into metal pots, and immersed in water. This serves effectively to quench any tendency to arcing when large high-tension currents are interrupted. All the high-tension parts in this out-out are entirely covered with porcelain or other

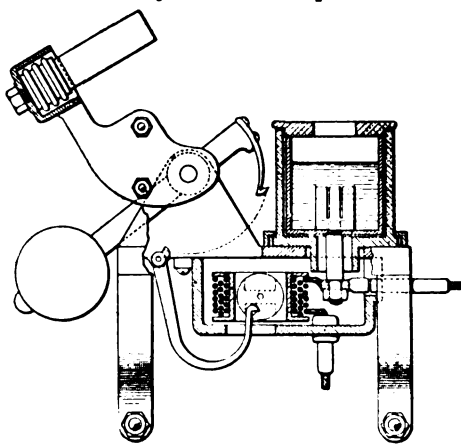


FIG. 5.

insulating material. The releasing mechanism is practically the same as in the low-tension out-out.

Fig. 6 is a diagram of the Hastings switch gear. We have found this arrangement entirely satisfactory in every respect. It has not only enabled us to cope with several breakdowns to machinery without interruptions to the supply, but it has also effected a saving in coal, etc., during the past 18 months of over £400. This has been saved by the arrangement referred to enabling us to work safely without running a spare plant.

All the machines are arranged to feed into a common pair of inner and outer bus-bars. The inner bus-bar, however, is divided at A, by a change-over switch, C, into two separate branches. One of these, A₁, is permanently connected to A, but the other branch A₂, may be connected either to the main bus-bar or to a spare bus-bar, B. Normally it is connected to the former. Each machine and circuit is equipped with a two-way switch, T, by means of which any machine or any circuit may be connected either to the inner bus-bar or to its auxiliary branch. In the diagram only three circuits and three machines are shown. The maximum output of the machines is 60 amperes, and the total load of the three circuits is assumed to be 120 amperes—namely, 60 on No. 1, 40 on No. 2 and 20 on No. 3. By setting the circuit two-way switches, T₂ and T₃, over to the left, circuits 2 and 3 are connected directly on to the A₁ branch of the inner bus bar; whereas, T₁ being set over to the right, circuit 1 is connected on to the A₂ branch. The machines Nos. 2 and 3 are connected in parallel by their two-way switches directly on to the inner bus-bar, A. And the machine No. 1 is kept turning as a spare, with its two-way switch over to the right, thereby connecting it on to the

spare bus-bar, B. The change-over switch C is constructed to be released by a solenoid excited off any convenient source, E. Inserted in series with it are two switches, S and L₁, L₂ or L₃. Both the S and one of the L switches must be closed together to excite the solenoid. When S only is closed it completes a circuit through an electric bell, which can be heard anywhere in the station. The driver has

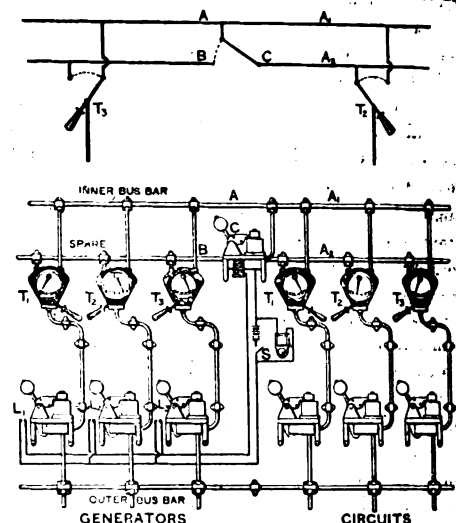
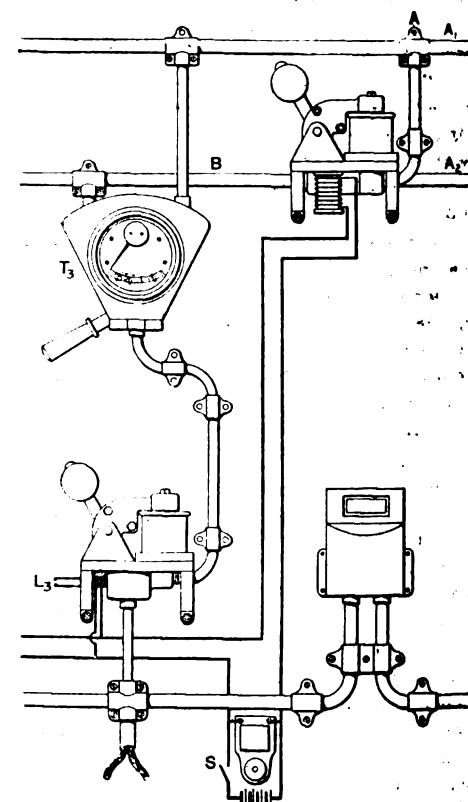


FIG. 6.

instructions that whenever that bell rings he must immediately run the spare plant up to speed. Now, if either of the running plants break down, the switchboard attendant merely has to close switch S, and then as soon as the volts on the spare machine have risen to normal, or before if necessary, he releases the out out switch of the faulty machine. The weight of this on falling closes switch L₁, and so completes the circuit through the solenoid of the releasing change-over switch C. This disconnects the bus-bar A, with its load of 60 amperes from the inner bus-bar A, and transfers it to the spare bus-bar



DETAILS OF ONE SECTION OF FIG. 6.

B at precisely the same moment as the generator supplying 60 amperes is disconnected from the inner bus-bar. Thus the lights on the circuits Nos. 2 and 3 are not affected as they would be if the change-over were not done simultaneously with switching out the faulty machine; and the lights on No. 1 circuit only give a momentary flicker, which, as a rule, is not even noticed by the consumers.

Of course the use of a spare bus-bar is not original,

but we believe that the simultaneous method of change-over is.

In the discussion on a paper read before the Northern Society of Engineers on switch gear last year, it appeared to be the general opinion of engineers present that all high-tension connections should be absolutely enclosed. But it was objected that it did not appear possible to do so without having exposed connections at the back of the board, and boards with backs to them increased rather than decreased the risk of accidents. A suggestion was also

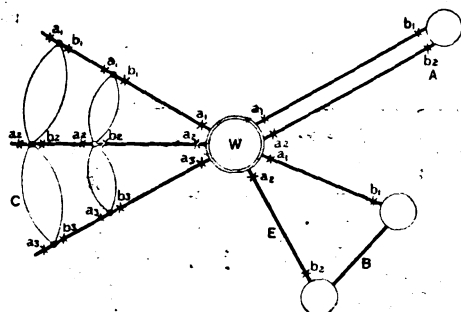


FIG. 7.

made in this same paper that a full-sized diagram of connections painted on the walls above the switch gear would often prove useful, but other engineers thought that the switch gear should be its own diagram. We venture to think that in the switch gear shown in Fig. 6 we have succeeded in complying with both of these specifications. The leads from the machines are carried in porcelain or other insulating pipes directly up to their respective out-outs, from these to the two-way switches via their ammeters, and so on to the bus-bars. All the high-tension connections, both in the out-out switches and the two-way switches, are entirely enclosed; and, as these switches and the conductors are bolted and clipped to the surface of a brick wall, all the connections are diagrammatically shown at a glance.

Some form of excess-current out-out should certainly be used on the feeders. We prefer magnetic out-outs to fuses, as we find them more reliable. They can also be used as switches if necessary, which is a distinct advantage. At any rate, whatever form of out-outs is used, their operation should on no account be permitted to interrupt the supply to any consumers.

It is curious that engineers have not paid more attention to the duplication of electrical mains. It is the custom to spend thousands of pounds on duplicating boilers, engines, dynamos, and other plant which is directly under the engineer's control; but no steps are taken efficiently to duplicate that part of the system over which he has no direct control, and which is always at the mercy of such external forces as gas explosions, burst water mains, fires, pick-holes, etc.

It is true many engineers arrange their mains on

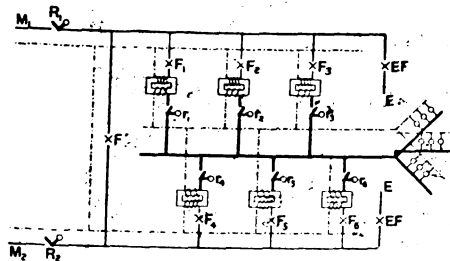


FIG. 8.

some ring system, so that any portion of it may be made dead for repairs, extensions, etc.; and some go even further, and fix fuses at intervals round the ring, so proportioned that a fault will only out out a certain section of the lights. But that is not sufficient. We ought not to be satisfied until we are able to guarantee an absolutely constant supply to everyone. The problem of how to do this has been troubling us at Hastings for years. But we now

feel satisfied that we have solved it. Our method of doing so is shown in Fig. 7.

Each sub-station or feeding point is supplied from the works, W, by two feeders, either by running to each two distinct mains, each sufficiently heavy to carry without excessive fall of pressure half the load of the sub-station, as shown at A, or by connecting together two sub-stations, each supplied by separate feeders, as at B; or, in the case of low-tension distribution, by running radial feeders from the generating station, and connecting the several feeding points on these to corresponding feeding points on an adjacent feeder by the distributing mains, as shown at C. If a fault occurs on either of these feeders, the current will be supplied to it both directly from the generating station and also via the adjacent feeder and connecting mains. To prevent this fault from short-circuiting the whole of the system, fuses have previously been inserted in the feeders at a_1, a_2, b_1 and b_2 . A little consideration will show, however, that this arrangement can never be satisfactory, for it is obvious that either one of these feeders may at any time have to carry as heavy a current as the others; consequently, they must all be equally fused. Now, if a short-circuit occurs at, say, E, fuse a_1 will blow. The current will then be

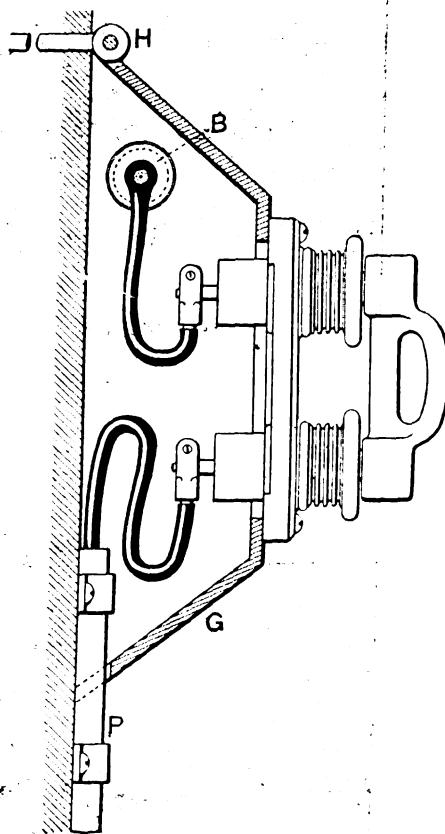


FIG. 9.

supplied via a_1, b_1 and b_2 . Now fuse b_2 should, of course, blow, and so out out the faulty main, leaving both sub-stations to be supplied via feeder 1. But this will not happen, because a_1 and b_1 would have to carry sufficient current to blow b_2 , in addition to the useful current taken by the sub-stations. The result will naturally be that a_1 or b_1 will invariably blow before b_2 , thus cutting off the lights supplied by both feeders. Now, if fuses b_1 and b_2 are replaced by discriminating out-outs, no amount of current flowing in its normal direction will cause them to operate, but a comparatively small return current will immediately release them. As the only conditions that can possibly cause the current to flow back from the sub-stations to the generating station is a fault on the feeder between these points, this form of out-out can be relied upon to operate only when it is required to do so.

It is, of course, very essential that the out-outs used for this purpose should be made not to operate if either the series or shunt current is interrupted

separately or simultaneously, as it would cause a great deal of trouble if the supply from the works was ever interrupted for a few seconds and all the out-outs on the mains were thereby caused to operate.

Cut-outs that are opened with a spring or springs should also be avoided, as it is impossible to make them sensitive and reliable, owing to the fact that the catch has to be released against the maximum tension of the springs; and further, these springs must be very stiff, as in addition to overcoming the friction of the contacts when they are clean, a large margin must be allowed to overcome the increased friction that will certainly be caused by corrosion of the contacts after they have been in, say, a few months. A falling weight seems much better suited for the purpose than a spring, for the pressure on the releasing catch is comparatively small, and the sharp blow upon the contact arm is just what is required to overcome with certainty any tendency to sticking due to corrosion.

Cut-outs should have no screws about them liable to work loose and so release the catch and open the circuit.

For burying under the pavements they should be as compact as possible, as the space is then very limited.

They should also be unaffected by rust, dust, damp or corrosion, and precaution should be taken to prevent any possibility of their being caused to operate by external vibration. They should be made to cut out with as small a current as possible, to prevent excessive arcing when the circuit is interrupted.

The out-out illustrated in Fig. 5 has been designed to comply with these and other requirements.

Another very frequent cause of local interruptions is the failure of primary fuses of transformers. It certainly appears to be advisable to use some form of excess-current out-out between the primary winding of transformers and the mains supplying them. But the object of this out-out should be, not to prevent the transformers from being overloaded, but to protect the mains from being short-circuited by a faulty transformer. Where two or three transformers are coupled together no good can come of cutting one of them out of circuit because it is overloaded, for if one is cut out the extra load is thrown upon the others, thus invariably blowing their fuses as well and cutting off the supply to the whole district.

We consider that a transformer fuse should not blow unless the excess current exceeds the normal current by about 300 per cent.

Fuses between the secondaries of transformers and secondary bus-bars are invariably worse than useless. Take, for instance, the case of three transformers of equal size feeding a common bus-bar. If one of these fails, the current will rush back into it from the other two; but, as these have to supply the useful current to the mains, in addition to that required to blow the faulty transformer's fuse, they will blow their own fuses before that of the faulty transformer. Obviously these fuses should be replaced by discriminating out-outs.

Fig. 8 is a diagram showing the equipment of a sub-station we now have in hand. The two high-tension feeders from the generating station, M_1, M_2 , terminate in two return-current out-outs, R_1 and R_2 . Beyond the out-outs they are connected together by the fuse F . Fuses F_1 and F_2 , etc., are inserted in series with the primaries of each transformer. Return-current out-outs, r_1, r_2, r_3 , etc., are inserted in series with the secondaries of each transformer. The primary connections of the sub-station are divided into two distinct halves; the inner bus-bar of each half is equipped with an earthing fuse, EF . Any man found working on the primary connections of either side without the earth fuse inserted will be instantly dismissed. Either half sub-station can, of course, be made dead by opening the return-current out-out of the feeder to which it is directly connected

fuse F, and the secondary return-current out-outs of that side.

There are no high-tension connections exposed in this sub-station. The primary out-outs are of the type illustrated in Fig. 5. The fuses are also of an enclosed type, and are screwed to two cast-iron frames—one frame for each half of the station. A section of these frames is shown at G, Fig. 9. The bus-bar, B, to which the transformer fuses are connected, is supported on insulators inside this frame. These frames are hung on hinges, H, so that they can be lifted to enable the connections to the fuses to be periodically examined. High-tension cables are run down to the transformers in porcelain tubes, P, clipped to the walls. The high-tension apparatus for one half of the station is on the north wall, and that for the other is on the east wall. The low-tension return-current out-outs, which also serve as secondary switches, are on the south wall, and the distributing bus-bars and instruments are on the west wall. This sub-station is a building 12 feet long by 8 feet wide by 7 feet 6 inches high. It is built above ground in a back garden in the center of the district it supplies. We pay £10 per annum for the rent of the ground it stands upon.

Several of our existing sub-stations are placed under the pavement. These have been such a source of trouble to us that we are now abandoning them entirely.

Arrangements are made to cut off all the transformers except one small one during the hours of light load, not only for the purpose of saving the current wasted in exciting them, but also to allow them to cool down between each heavy shift. We expect by so doing to greatly increase the life of our transformers.

Whether it is advisable to equip the low-tension distributors with out-outs or not, is a question upon which we should be glad to hear the opinion of other engineers. We are inclined to think that, if a 200-volt short-circuit occurred on a cable not exceeding 1 square inch sectional area, it would in most cases burn itself out before it damaged other parts of the cable. If we could be sure of this, we should endeavor to loop all of our distributors and insert in series with each main a magnetic out-out adjusted to operate when the current exceeded five times the normal. If the main burnt asunder before the out-outs operated, the supply would not then be interrupted to any consumers.

Presumably everyone will admit that excess-current out-outs are necessary on electric light services where they enter consumers' premises, but we think the majority of central station engineers will agree with Mr. Sayers, that they should not operate until the normal current has been exceeded by at least 300 per cent. Is it not possible that the number of branch out-outs at present used to comply with the fire insurance regulations might be reduced? It appears to us to be rather a question whether or not so many of these out-outs do tend to reduce the risk of fires. Consumers who are repeatedly troubled by these branch fuses melting are apt to discover that a fuse replaced by a stout piece of copper wire gives them far less trouble. Now, if the connection to one of these short-circuited fuses should work loose, it gets hot, the heat is transmitted to the cable and a smell of burning is the result. Of course, if no branch fuses were used, it would be advisable entirely to enclose the house wiring in some form of fire-proof conduit instead of in wood casing; but we are inclined to think this would be a preferable arrangement both for the prevention of interruptions to the supply and for the reduction of fire risks.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE ELECTRO-CHEMICAL INDUSTRIES OF ENGLAND.

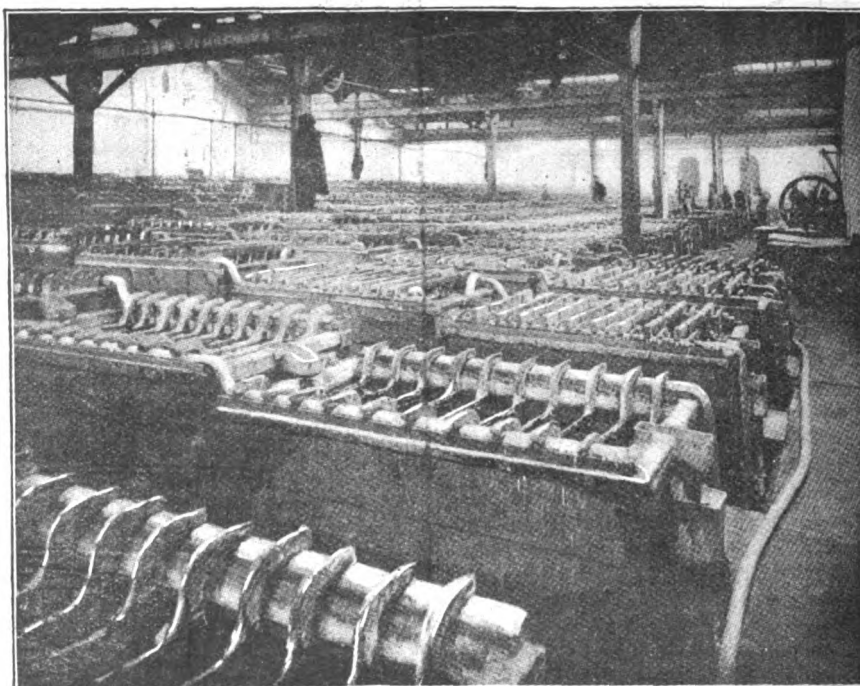
ARTICLE II.

(Specially Contributed by JOHN B. C. KERSHAW, F. I. C., London.)

The British Aluminium Company's Works, Foyers, Scotland.—This company shares with the Acetylene Illuminating Company the only large water-power yet developed in the British Isles for electro chemical or electro-metallurgical operations.

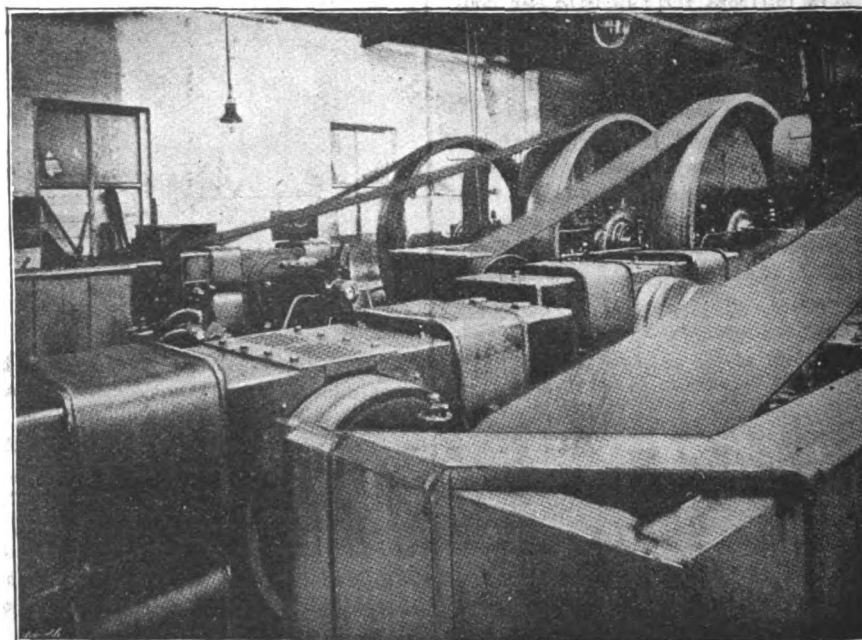
The company was formed in 1895, with a nominal

work was commenced at Foyers in July, 1895, and the manufacture of aluminum at Foyers commenced in June, 1896. The power available at this spot has been gradually developed; the hydraulic engineering works and generating plant have been recently completed, and 3,500 HP. is now produced at the turbine shafts for conversion into electrical energy. The current produced is divided between the two manufactures carried on at this spot—aluminum and calcium carbide; but the writer has not been able to ascertain the proportion of the total power which has been used for the aluminum manufacture. The process used is that of Herault, and differs from that



VIEW I.—THE DEPOSITING VATS, WIDNES WORKS, ENGLAND (BOLTON & SON'S COPPER REFINERY). share capital of \$1,440,000 of which \$480,000 represents shares issued to the vendors of the patent rights. There have been two issues of debenture

of Hall, worked at Niagara by the Pittsburg Reduction Company, only in unimportant details. There are five 10 feet turbines in position, each capable of



VIEW II.—GENERATING PLANT, WIDNES WORKS, ENG., 300 KW. (BOLTON & SON'S COPPER REFINERY).

representing \$480,000, and mortgages have been raised equal to \$177,600, so that the total liabilities of the company are at present \$2,097,600. The company possesses a bauxite mine at Glenravel, Ireland; an alumina works at Larne Harbor, also in Ireland; a power plant and reduction works at Foyers, Scotland; rolling mills at Milton, England, and a carbon factory at Greenock, Scotland. The construction

developing 700 HP. with the 350 feet head of water under which they work. The armatures of the dynamos are keyed on to the same vertical shaft; each weighs 14 tons. Three more sets of generating machinery are to be added to the present five; this addition will bring up the power available at Foyers to 5,600 HP.

The profits made since the commencement of man-

manufacture in June, 1896, have enabled this company to pay dividends on its preference shares up to the end of 1896—5 per cent. for 1895 and 3½ per cent. for 1896.

The views shown represent the depositing vats at the Widnes Works and the generating plant at Foyers. Further details concerning this manufacture will be found in the issue of *ELECTRICITY* for December 8, 1897.

Messrs. Bolton & Sons' Copper Refineries at Froghall, Staffordshire, and at Widnes, Lancashire, England.—Some details of these refineries, the former of which is the largest in Europe, were published in the article upon Electrolytic Copper by the present writer in the issue of *ELECTRICITY* for November 17, 1897. This firm possesses, in addition to its two

in size to those used at Froghall. Belt-driving is resorted to (see View II); the capacity of the generating plant is 300 kw.; 350 tons of copper per month can be deposited at this works, and the combined capacity of the two works is therefore 1,050 tons per month, or 12,000 tons per annum.

THE TEMPERATURE OF INCANDESCENT LAMPS.*

I have already described† a purely electrical method of measuring the temperature of incandescent lamps, and more generally of any radiating body whatever. This method consists in studying: (1) the variation in the resistance of the lamp as a function of the difference of potential at the termi-

meter and a voltmeter and presented no difficulty; the subsequent ones were more difficult; they were carried out in the following manner:

A special interrupter enables the following operations to be performed:

1. At the time zero, the current of the lamp is broken.

2. Immediately after, the lamp is introduced into an auxiliary circuit including an accumulator and a resistance box.

3. At the time t , an instantaneous contact brings the two terminals of the lamp into connection with the plates of a condenser.

4. This condenser is discharged through a ballistic galvanometer. These various operations are executed by a slide which moves in a direction parallel to itself between two grooves; the intervals of time are measured by a tuning-fork which inscribes its vibrations on smoked paper; it is evident that at these high temperatures the cooling is very rapid, and that it is necessary to be able to measure accurately fractions of a second. A simple calculation then enables us to find the resistance of the lamp at any given moment.

The experiments were carried out on four lamps, A, B, C, D, of 65 volts and 10 candles. I will call t the temperature, R_0 the resistance of the lamp to the ordinary temperature, R_t its resistance to t° , p the weight of the filament expressed in milligrams, E the tension at the terminals. These are the results obtained:

Lamps.	E	p	R ₀	$\frac{R_t}{R_0}$	t
A	65	6.3	175	.53	1,720°
B	65	5.35	170	.54	1,810°
C	65	5.2	170	.52	1,830°
D	65	4.8	170	.53	1,620°

We see that the results relating to the lamps B, C, D are very similar; the lamp A, for some reason or other, gives a somewhat higher temperature.

However this may be, the above results are of some importance when we consider the differences in the figures of the various writers that have treated this subject. H. F. Weber, in fact, mentions these temperatures as hardly exceeding 1,300°, whereas M. le Chatelier gives 1,800°.* It will be seen that our results more nearly approximate to the latter estimate, especially as we have reason to think that our lamps were less over-run than those of M. le Chatelier; these are the variations of resistance given by him:

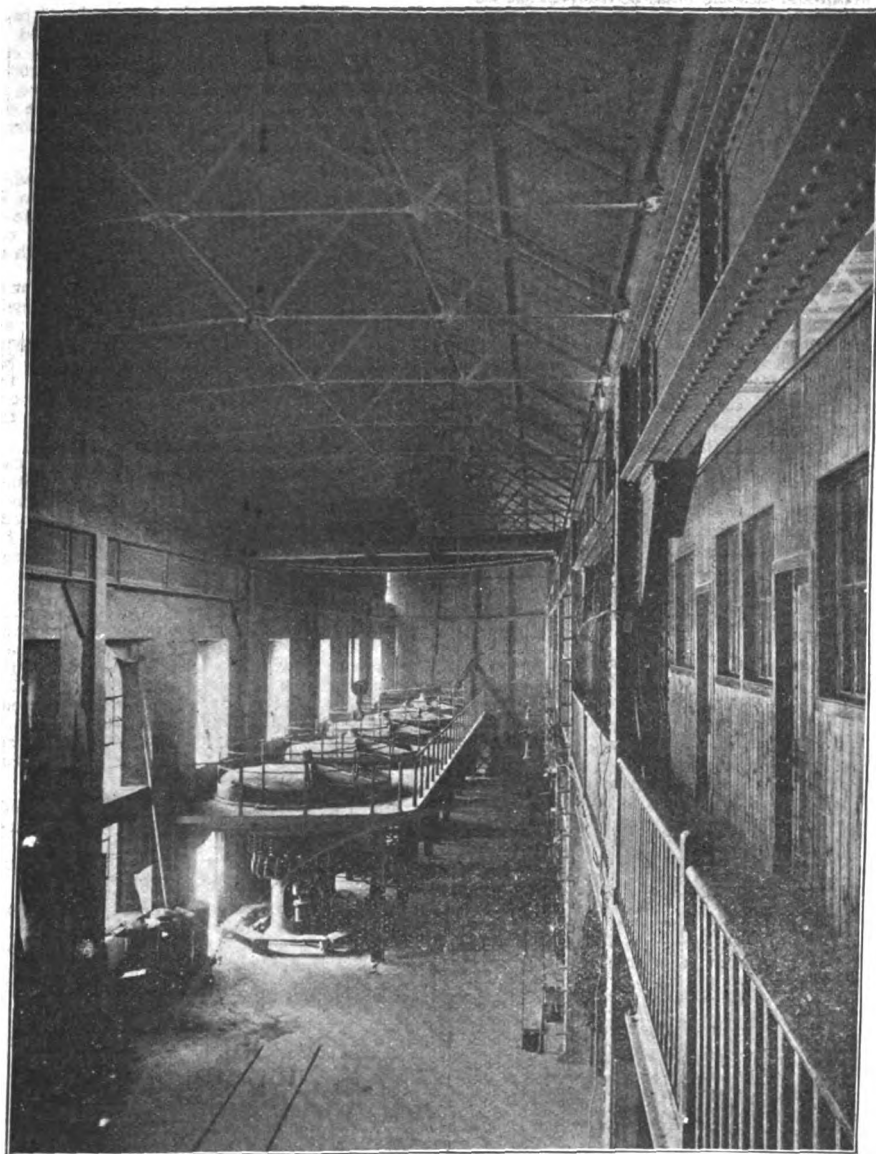
t	R ₀
15°	1.00
700°	.75
1,000°	.66
1,400°	.57
1,800°	.49
2,100°	.44

At the temperature of normal working, the ratio $\frac{R_t}{R_0}$ was .49 for M. le Chatelier's lamps, whereas this same ratio attained to .53 in our experiments; now, at this value .53 corresponds exactly to the temperature of 1,600° in M. le Chatelier's table.

The principal cause of error in the above experiments lies in the light weight of the filament; it would be easy to remedy this by working with low voltage lamps. We can, in fact, easily show that, with an equal lighting power, the weight of the filament of a lamp varies in inverse proportion to the two-third power of the difference of potential at the terminals.

From the above experiments we can deduce curves of the variation of the total radiation as a function of the temperature, but this question is too important to be entered upon here.

* *Journal de Physique*, 2d series, Vol. I., p. 208.



VIEW III.—THE GENERATING PLANT, 3,500 HP. (BRITISH ALUMINIUM CO.'S WORKS, SCOTLAND).

refineries, wire-drawing mills at Oakmoor and Birmingham, and rolling mills at St. Helens, and is the largest producer of telegraph and telephone wires in the country.

At Froghall there are four sets of Corliss valve triple expansion condensing engines working under 150 lbs. steam pressure. These engines each drive two 75 kw. dynamos of the Elwell-Parker type, and the total output of the generating plant is thus 600 kw. Rope-driving is resorted to in this works, and neither the engines nor the dynamos can be considered of the best modern build and design. There are a large number of vats at Froghall worked in series of from 60 to 70 vats; 700 tons of copper per month is the maximum capacity of the plant, but a portion of it is used for other depositing work.

At Widnes there are two Galloway engines, each of which drives two Elwell-Parker dynamos similar

nals; (2) the variation, as a function of the time, in the resistance of a lamp which is cooling. From this we can easily deduce the curve of the watts radiated as a function of the time, and consequently the total number of joules or small calories given off by the lamp. The filament is then weighed, and from M. Violle's formula:

$$Q = .355 t + .00006 t^2$$

we deduce the temperature t (assuming that the filament is made of pure carbon).

This method was applied, under my directions, by Messrs. Gindre and Fréau-Ozeune, then pupils at the Ecole Supérieure d'Electricité†; the first measurements were taken with the aid of an ampero-

* Note presented to the Académie des Sciences, March 7, 1898. From the *Electrical Review*, London.

† See *L'Electricien*, Vol. XII., p. 828.

The experiments were made at the Central Electrical Laboratory.

LEGAL NOTES.

Some time ago the city of Atlanta, Ga., passed an ordinance to regulate the rate of fare to be charged by the Atlanta Street Railway Company. The Old Colony Trust Company of Boston, as trustee for the bondholders, brought suit against the city of Atlanta seeking to enjoin the city from enforcing the order, claiming that the ordinance was unconstitutional. The case was tried in the United States Circuit Court at Atlanta, and a decision was given in favor of the Old Colony Trust Company and against the constitutionality of the act. The city of Atlanta took an appeal. The Circuit Court of Appeals at New Orleans has just sustained the decision of the Circuit Court at Atlanta, thereby establishing the fact that the city cannot by ordinance regulate rates of fares so as to interfere with the profitable operation of the road. The injunction is perpetual.

On the 25th ult., at Pittsburg, Pa., a verdict of \$18,250 was given in favor of Alexander R. Todd, in the damage suit brought by him against the Second Avenue Traction Company. The plaintiff was a baggage master in the employ of the Pittsburg, Ft. Wayne and Chicago Railway Company. The accident in which he was hurt occurred April 8, 1897. A traction car in charge of a motorman and a dispatcher reached the railroad crossing and was stopped in order to allow a train that was coming along the Ft. Wayne tracks to pass. At that time the dispatcher of the trolley car was examining the controller on the car, and when through with his examination, he is alleged to have turned to the motorman and saying: "The car is all right. Turn on the power." The motorman, it was alleged, reached up and turned on the power and the car immediately shot forward, breaking through the safety gate of the railroad company, which had been let down to warn all approaching vehicles and people, and crashed up into the rear car of the Ft. Wayne train, a baggage car in which Baggage Master Todd was standing. The force of the blow crushed in the side of the train, and threw Todd, who was a very large, strong man and in perfect health, across the car against a steam register. Two of his ribs were broken close to his spine, and he received internal injuries to the spine from which several physicians testified he will never recover.

THE NEWS.

What Is Going On in the Electrical World.

LIGHTING PLANTS.

Alaska.—The Alaska Light & Power Company has installed a first-class electric light plant at Skagway and the streets of that place are now so well illuminated that all the outside fun is visible. The company was organized at Tacoma, Wash., and the officers are: President, C. B. Hurley; secretary and treasurer, Chester Thorne; general manager, W. G. Gaston.

Algona, Ia.—Among contemplated improvements in this town during the present summer and fall, is the establishment of an electric lighting system.

Baton Rouge, La.—A bill has been introduced in the Legislature to authorize the town of Ruston to issue bonds to the amount of \$50,000 for electric lights, waterworks and a street railway.

Binghamton, N. Y.—The board of supervisors has passed a resolution authorizing the county treasurer to borrow \$3,500 to be applied by the building committee to the purchase of electric light fixtures for the new Broome County Court house.

Brooklyn, N. Y.—Bids were opened on the 31st ult. by Henry S. Kearney, Commissioner of Public Buildings, Lighting & Supplies, for street lighting in the borough of Brooklyn. The lowest bidder was the Kings County Electric & Illuminating Company. Five bids were submitted by this concern, one for the entire borough and four others for the sections. The prices were all the same, namely, 30 cents a night for each 1,200 cp. arc lamp, 35 cents a night for each 2,000 cp. arc lamp, and 14 cents an hour an ampere for incandescent lights. The other bidders were the Edison Electric Illuminating Company, the Citizens' Illuminating Company and the Mutual Electric Light Company.

Covington, Va.—The Mayor may be addressed concerning erection of an electric light plant.

Denver, Col.—The Lafayette-Louisville Electric Company, recently incorporated, intends to introduce into the Northern Colorado coal fields a new plan for

lighting the mines, substituting electric lamps for the dangerous and malodorous oil lamps now in use by the operators.

Des Moines, Ia.—The "Leader" says: "It is generally understood that the McCaskey & Holcomb Company stands ready to commence work on its contract for the erection of the city lighting plant as soon as Judge Bishop rules on the motion to dissolve the injunction, provided the ruling is favorable to the city and without waiting an adjudication by the Supreme Court. Correspondence has been had to this effect and the contractors have said that if work is commenced the plant can be rushed through to completion this year."

Dubois, Pa.—The plant and franchise of the Dubois Electric Light, Power & Heat Company were sold at trustee's sale on the 28th ult. for \$5,000.

Fenton, Mich.—The sale of the electric light plant for \$7,000 by the receiver of the defunct State Bank, which included the plant among its assets, was contested by a large number of the depositors, who applied to the court for and obtained a hearing. While this was under way, a telegram from A. S. Hatch of Detroit, was received offering \$7,600 for the plant. The court, Judge Wisner, then ordered that the plant be readvertised for sale, and that bids be received until June 29 next, to be opened in court the day following. F. L. Thompson, the first buyer, will fight the action in the courts.

Freeport, L. I.—The people of this village celebrated the introduction of electric light on the night of the 28th ult. There was a grand parade of firemen and citizens and a fine display of fireworks. The plant was constructed at a cost of \$20,000. There are 100 arc lights of 1,200 c.p.

Hammonton, N. J.—A movement is on foot to light the Atlantic County Road from Hammonton to Egg Harbor by electricity.

Kaukauna, Wis.—At an adjourned meeting of the council the committee to which was referred the matter of electric street lighting made a unanimous report that the franchise let to the Kaukauna Electric Light Company, and for which they hold a ten-year contract to furnish arc lights, was null and void, for the reason that it had been illegally passed.

Lexington, Ill.—The electric light plant, which has been in litigation for some time, has been sold by order of the court. Capt. F. J. Fitzwilliam and J. T. Roney, two of the original stockholders, bid in the property for \$6,000.

Los Angeles, Cal.—There is some agitation here in favor of putting in a municipal lighting plant, and the council is disposed to call an election for the purpose of ascertaining the sense of the people on the question.

Louisburg, N. C.—The Louisburg electric light plant has been purchased by J. P. Winston who will place the same in operation.

North Tonawanda, N. Y.—The board of aldermen has provided for a special election to be held here on the 17th inst. to vote on a proposition to raise \$15,000 for street lighting purposes.

Philadelphia.—The "Stockholder" says: "Revival of the proposition to establish a municipal electric lighting plant in Philadelphia is not regarded with special concern by the leading interests in the companies which now furnish the city with lights. As the lighting service at present furnished is quite satisfactory, and relatively reasonable in price compared with that of other cities, it is altogether probable that the project will be permitted quietly to expire in committee."

West Superior, Wis.—A satisfactory understanding with the lighting company having been reached, the city has decided not to put in its own electric lighting plant.

STREET RAILROADS.

Baltimore, Md.—The car barn of the Baltimore Consolidated Railway at Irvington was destroyed by fire on the 29th ult.; 130 cars were burned. The loss is about \$260,000.

Brooklyn, N. Y.—The passenger traffic of the trolley roads in this city on Memorial Day was the largest in the history of the various roads. The number of fares taken in aggregated over 1,000,000. The receipts on the Brooklyn Heights system amounted to \$27,140 and they were correspondingly large on all the other roads.

Doylestown, Pa.—The first railway car propelled by electricity that ever entered Doylestown within its more than a century of existence crossed the borough line Tuesday afternoon, May 24, 1898, and the Doylestown "Democrat" says the news of Admiral Sampson's complete triumph over the Spanish fleet could not have created half the excitement in town as did the arrival of the trolley car from Willow Grove.

Dunellen, N. J.—The officials of the Brunswick Traction Company are making preparations for the extension of the branch from New Brunswick to Bound Brook, and through the latter place to Dunellen. The contracts have been awarded and the work of construction will be commenced. It is believed that cars will be running over the new line before July 1.

Elkhart, Ind.—J. J. Burns of Chicago has bought of Naugle, Holcombe & Co. of Chicago the franchise and right of way of the Elkhart, Goshen & Southern trolley line between here and Goshen, ten miles. Mr. Burns owns the electric railways in Goshen and Elkhart, and will build an interurban line this summer.

Fall River, Mass.—The consolidation of the Globe Street Railway and the Fall River Street Railway has been accomplished and both roads are now operating under one management, that of the Globe Company.

Frederick, Md.—The president and directors of the Frederick, Thurmont & Northern Electric Road Company have appointed a committee to draw up at once an estimate of the costs and expenditures of operating the road and an estimate of probable earnings. The route of the new road is from Frederick to the Pennsylvania State line, by way of Thurmont and Emmitsburg. The promoters, who are representative business men, decided to push forward the enterprise in order to have the road built as soon as possible. Col. L. V. Baughman is president of the road.

Manchester, Ia.—The plans for the proposed electric railway from Manchester to Colesburg are nearly perfected and there is a good prospect of its early construction as the farmers along the route are taking great interest in the project and are subscribing for stock in it. The principal promoters of the road are J. H. Rafferty and L. S. Cass of Waterloo and J. H. Shields, formerly superintendent of the Chicago Great Western.

Malone, N. Y.—An electric street railroad in Malone seems practically assured. The village board of trustees has voted to grant the charter, and the company will be incorporated with a capital of \$30,000. The name of the corporation will be the Malone Electric Street Railway Company. The names of the directors are not made public, but have been agreed upon. Four of them will be residents of Malone.

Plymouth, Mich.—The council has granted a franchise to the Detroit, Plymouth & Northville Railway Company to construct and operate an electric railway within the village. It is expected that the company will have cars running from Detroit by the 4th of July.

Somerville, N. J.—Chancellor McGill, on the application of G. D. W. Vroom, counsel for the New York & Philadelphia Traction Company, has made an order vacating an injunction restraining the company from operating its line in Bridgewater township. Since the granting of the injunction last fall, the township authorities of Bridgewater have passed an ordinance allowing the traction company to operate in the township.

Sycamore, Ill.—A fifty-year franchise for the principal streets of this city has been granted to the Geneva Lake, Sycamore & Southern Electric Railway Company. The road, which was incorporated last January, runs from Geneva Lake, Wis., to Morris, Ill. The whole length of the road is 110 miles and it crosses ten other lines, nine of which lead to Chicago and one to Milwaukee. Right of way has been secured over the entire line and work will, it is said, start at once. The officers of the road are: President, James Brannen; secretary, George B. Morris; treasurer, George Brown; general manager, John B. Whalen. The board of trustees, besides the officers, is composed of A. K. Bunker, John R. Kellogg and Emil Arnold, Woodstock; A. White and S. Baker, Sandwich; H. F. Jones, Hebron; D. S. Brown, Geneva; P. T. Parkhurst, Loren Woodard and F. W. Patrick, Marengo; Edward Delana, Cortland.

Tiffin, O.—The greater part of the right of way has been secured for the Tiffin, Fremont & Lakeside Electric Railway, and work on the line will begin in a short time. The route adopted touches Fort Seneca and Old Fort, between Tiffin and Fremont.

Wichita, Kan.—The charter of the company organized to rebuild the street railway has been declared forfeited by the city council. It is reported that another company is about to be formed to take the road in hand with money enough to complete it. A prominent citizen says "the new company will soon come before the city council and ask for a charter, and when they do so they will have money ready to go right ahead to build their electric light plant and street railway."

COMPANY MATTERS.

Media, Pa.—The Media Electric Light, Heat & Power Company will on July 8 vote on the question of a reduction of the capital stock from \$100,000 to \$40,000.

Pittsburg, Pa.—A joint agreement of merger has been ratified by the stockholders of the Homestead & Highlands Street Railway Company, the Braddock & Homestead Street Railway Company, and the Braddock & Duquesne Street Railway Company, under the name of the Monongahela Street Railway Company. The Monongahela Street Railway Company also ratified the agreement.

Richmond, Va.—The Old Dominion Electrical Development & Power Company, R. Lancaster Williams president, has published a notice changing the location of the principal office of the company from the city of Richmond to the county of Norfolk.

Vicksburg, Miss.—At the meeting of the stockholders of the Vicksburg Railroad, Power & Manufacturing Company, held on the 23d ult., the final organization under the State charter was made and the following officers and directors were elected for the ensuing year: President, J. C. Shaffer of Chicago; vice-president, Percival Steele of Chicago; secretary, M. J. Mulvihill of Vicksburg; treasurer, B. W. Griffith, president First National Bank, Vicksburg; directors: J. C. Shaffer, Percival Steele, F. S. Mordant, Jesse E. Roberts, S. E. Hughes, A. Rose and B. W. Griffith.

ELECTRICIANS IN THE WAR.

Col. George L. Gillespie of the Corps of Engineers and Col. Eugene Griffin, recently made Colonel of the First Regiment of Volunteer Engineers, are sitting daily in the Army Building, New York, as a board to examine applicants for commission in the proposed brigade. Among those who have successfully passed so far are Dr. Louis Duncan, professor of electrical engineering in Johns Hopkins University, well and favorably known in the electrical fraternity, and William Barclay Parsons, chief engineer of the Rapid Transit Commission, New York. Recruiting offices have been opened in New York at 335 Broadway, in Boston, Philadelphia, Baltimore, Norfolk, Richmond, Charleston and Savannah. The law under which the brigade will be recruited provides that each regiment shall have 1,106 enlisted men. The non-commissioned officers and privates in the brigade will receive higher pay than those of similar rank in other branches of the service. The privates will receive \$18 a month; corporals, \$24; sergeants, \$40.80; quartermaster-sergeants and sergeant majors, \$43.20.

Among the nominations sent to the Senate last week were the following: First Regiment U. S. Volunteer Engineers—To be Majors: Louis Duncan of Maryland, James Dubose Ferguson, District of Columbia.

About fifty men have enrolled at Denver, Col., for the volunteer engineering brigade at the office opened there under instructions from Col. Eugene Griffin.

The Terre Haute, Ind., "Express" says: "Chief Electrician Abe Balsley of the Street Railway Company has received a communication from friends at Washington asking him to accept a position with the engineering regiment being recruited for the war. Mr. Balsley is offered the position of lieutenant and a salary of \$1,600 a year."

PERSONAL AND MISCELLANEA.

It was one of Mr. Gladstone's rules never to have as a member of his Ministry any director in a stock company.

The Cincinnati "Commercial Tribune" states that Hugo Diemer, of Diemer & Hebble, electrical contractors, has accepted a position of responsibility with the Westinghouse Electric & Manufacturing Company, with headquarters at Atlanta, Ga.

A correspondent states that though he has no statistics before him he feels safe in saying that more mica is used in the electrical business, by manufacturers of dynamos, motors and insulating devices, than by stove makers and wall paper manufacturers combined.

Monroe S. Ross has resigned the position of chief engineer and electrician of the Woburn (Mass.) Electric Light & Power Company to accept the office of general superintendent of a large electrical establishment on Long Island Sound near New York State line.

A Maryland paper states that "the Cumberland Electric Railway Company has made a start toward establishing a zoological garden at the Narrows Park, having placed there a cage each of monkeys and squirrels and a baboon." In these times a Weyler too would add much to the attractions of the garden.

The steamship John Englis of the Maine Steamship Company has been purchased by the U. S. Government, and under the name of the Relief will be converted into an hospital ship. There will be a large number of wards on the vessel, each fitted out with the latest electrical conveniences and improvements. There will be thoroughly equipped operating-rooms and 500 patients can be accommodated in an emergency. More than twenty professional nurses aside from the regularly enlisted nurses will assist the corps of army surgeons and their assistants. There will be a sea water distilling plant, refrigerator and an apparatus for the manufacture of ice and carbonated waters. The ship will carry a complete X-ray outfit, donated by the General Electric Company, which will be used to determine the location of bullets, etc., in the wounded.

"The announcement of the death of Lieut. Col. William R. King at Rock Island," says the N. Y. "Sun" "recalled to the officers at Willets Point the stories that went the rounds four or five years ago about Col. King's big cannon magnet. Col. King constructed a magnet at Willets Point by winding two cannon with wires heavily charged with electricity, which was probably the largest instrument of the kind ever made. It demonstrated nothing new and it was of no practical use. Some of Col. King's inventions, notably his disappearing gun carriage, have been of great use, but this magnet was constructed merely as an interesting experiment. The yellow journal of the day, however, described this magnet as powerful enough to draw iron bolts out of passing ships when the electrical current was on full force. Starting with this statement the story of the big magnet made the rounds of the European papers, gaining strength as it traveled. It finally became a terrible instrument of destruction devised by Yankee ingenuity, and according to one account of it, which appeared in a French paper, its power was so great that if a naval vessel approached within six miles of it her guns would be torn from their fastenings and sent rushing toward the magnet. Col. King was a scientific man and he protested vigorously against these absurd exaggerations of his magnet, but it was impossible to stop the story until it had run its course."

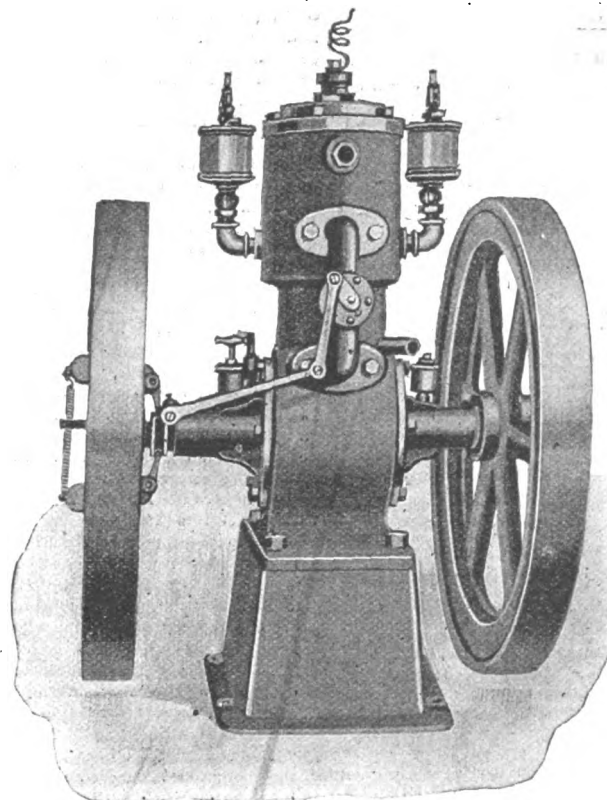
Dr. Johannes Horowitz, Vienna correspondent of the N. Y. "Times," in his letter dated May 14 states that Jan Szczepanik, the inventor of the telegraphoscope already described in these columns, is now exhibiting a device

at the Jubilee Exhibition in Vienna which does away with the laborious work of the designer in the textile industry. By utilizing photography for weaving purposes he can now in a single quarter of an hour accomplish what it has taken the designer months or even years to complete, according to the size of the design. As is known, a design that is to be woven must first be resolved into squares. Now in the case of a large gobelin the designer has at present to fill up millions of such little squares before it is possible to puncture the paste-board cards which are indispensable in the Jacquard loom. Szczepanik, however, totally abolishes the designer, and more than supplies his place by photography and electricity. "At the Jubilee Exhibition," says Dr. Horowitz, "only two gobelins woven by Szczepanik's new loom will be shown. One of them contains Mark Twain's portrait. For some time the great humorist has been giving the well-known Polish painter Henryk Rauchinger almost daily sittings for a portrait for the gobelin. The other day I visited the studio, and found the portrait nearly finished. It will be the best picture of Mark Twain ever painted. The second gobelin will contain the portrait of the Emperor Francis Joseph in his magnificent robes of state and surrounded by allegorical figures, and this portrait also will be from Rauchinger's brush. The Court has lent the painter the valuable state robes. Szczepanik showed me small landscapes woven in silk. They are of wonderful beauty, and of course, exacter than anything manufactured from hand-made Jacquard cards. They have been made on his present small loom."

COMMERCIAL PARAGRAPHS.

Gas and Gasoline Engines.

The steadily increasing popularity of gas engines for driving machinery of all kinds, and for the propulsion of boats, has led the Mianus Electric Company, Mianus, Conn., to place upon the market an engine of this class. This machine is said to be peculiarly fitted to supply the demand for an engine excelling in economy, safety and



2 1/2 HP. GASOLINE ENGINE.

durability. The illustration shown herewith is of a 2 1/2 HP. Palmer Stationary Gasoline Engine, of the two-cycle compression type, with an impulse at each revolution of the crank. The engine is provided with a fly-wheel governor, and is very compactly constructed.

The Mianus Company builds also gas and gasoline engines of the four-cycle type, having an impulse every other revolution. It manufactures engines from one to six horse-power, of both stationary and marine types, and can supply the castings and working drawings for the 1 HP. and 2 1/2 HP. engines to those who wish to construct their own engines. The engines made by this company are readily adapted to the driving of dynamos for electric lighting, motor carriage work and the operation of printing presses. They occupy but little space and consume a minimum quantity of gas or gasoline.

The Electric Appliance Company, Chicago, have recently closed a general Western agency arrangement for the celebrated Armorduct Interior Conduit. The Armorduct is the latest product of the Armorduct Interior Conduit Company, manufacturers of the well-known Armorduct

Steel Armored Interior Conduit. The Armorduct is a steel tube heavily enameled inside and outside by a special and exclusive process. The enamel placed on this tube gives a perfectly smooth interior with a coating which will withstand a temperature of 500 degrees. Bending and twisting the tube will not crack or break the coat of enamel. Further than this, the enamel is absolutely proof against the action of cements or acids of any description. The Electric Appliance Company undoubtedly have a very valuable specialty in their Armorduct and large sales may be safely prophesied.

Electric Novelties and Supplies.

We hereby call our readers' attention to the advertisement of the "S & B" Electric Company, 70-74 Fulton street, New York, which appears in this issue. This well known concern manufactures electric novelties and supplies, of almost every description. They are probably the largest manufacturers of batteries in the country, and also handle large quantities of electrical toys. We cannot do better than quote the following paragraph from a pamphlet they have recently gotten out: "Our 'Little Doctor' will cure the sick; our \$15 phonograph will amuse the old and young; our trolley car or electric boat will attract big crowds around your show-windows; our 'Midget Dynamo' will give you electric light and power; our small grenet battery will give you considerable pleasure; our motor castings will give you interesting work during idle minutes; our electric bicycle lamps will prove a boon to cyclists, and in fact any of the above will dispell the blue feelings of the old and make the youngsters happy."

Handsome Catalogue.

We are in receipt of a handsome 24-page catalogue recently gotten out by the Billings & Spencer Company of Hartford, Conn., the well-known manufacturers of machinists' tools and drop forgings. This catalogue is fully illustrated and contains lucid descriptions of drop-forged

pure lake copper commutator segments, numerous types of segments being shown, with the angle of segment, weight, and chord for one inch radius. The method of manufacturing these drop-forged commutator segments has been greatly improved of late, and this well-known Hartford firm is now prepared to furnish segments unequalled for uniformity and accuracy of gauge. These segments are manufactured under a United States patent dated November 6, 1888, and granted to Mr. C. E. Billings of Billings & Spencer Company. The rules and tables to be found in their 1898 catalogue, just issued, are extremely valuable and handy to have, and for this reason, if no other, the catalogue should be in the hands of all those interested in dynamo and motor construction.

We are in receipt of an attractively gotten up pamphlet, containing some twenty pages of matter, from Stone & Webster, well-known electrical experts and engineers, located at 4 Post Office Square, Boston. This firm makes a specialty of examining and reporting upon electrical properties for prospective investors, and the long list of prop-

erties examined by these gentlemen, as appears in the pamphlet, speaks well for their ability.

INCORPORATIONS.

The People's Light & Heat Company of Garland County, Ark. Capital stock, \$25,000. President, L. D. Cooper; directors: W. H. Perry, J. B. Wood, S. H. Stitt, John G. Lonsdale and C. E. Harrell.

The Lafayette-Louisville Electric Company, Lafayette, Col.—to operate in Boulder and Lafayette counties, Col. Capital stock, \$20,000. Incorporators: H. E. Bocker, John Carruthers and James Simpson.

The Heckert Light Company, Findlay, O. Capital stock, \$10,000. Incorporators: Henry W. Seney, Charles K. Friedman, Horton O. Rorick, G. G. Fenneberg and Curtis T. Johnson.

The Coplay, Egypt & Ironton Street Railway Company, Coplay, Pa. Capital stock, \$60,000. President, H. G. Horn; directors: Jilson J. Coleman, W. B. Clark, Morris L. Kauffman and J. G. Meyle.

The Citizens' Electric Light Company, Xenia, O.—to operate a light, heat and power plant in Xenia. Capital stock, \$10,000. Incorporators: I. W. Newcomer, W. S. Fawcett, W. R. Baker, A. J. Chatfield, J. B. Lewis and Harry L. Canfield.

The Sheffield Electric Light Company, Sheffield, Ill. Capital stock, \$9,000. Incorporators: T. Sprague, B. F. Dewey and W. E. Jones.

The North Shore Interurban Railway Company, Chicago, has certified to a change of name to the Chicago & Milwaukee Electric Railway Company, and to an increase of capital stock from \$640,000 to \$1,000,000.

The Howard Electric Company, Chicago—to manufacture electrical appliances. Capital stock, \$25,000. Incorporators: Robert Greer, William Greer and James H. Parker.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED MAY 31, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

601,729. Elevated Electric Car-Line. Joe H. Cooley, Paris, Tex. Filed Aug. 13, 1897.

601,747. Electric-Railway. John H. Guest, Boston, Mass., assignor to Linus M. Child, Edgar O. Achorn, R. Sherman York and William L. Whitcomb, same place, and Charles H. Moore, Springfield, Vt. Filed Oct. 20, 1896.

604,866. Signal for Electric Railways. William H. Jordan, Brooklyn, N. Y. Filed Feb. 16, 1897.

604,911. Electric Railway. Frederick D. Sweet, Elyria, Ohio. Filed Nov. 4, 1897.

604,968. Automatic Current-Distributor for Electric Railways. Jean Claret and Olivier Vuilleumier, Paris, France. Filed May 4, 1897.

605,036. Third-Rail Underground Electric-Railway System. Louis E. Watkins, Springfield, Mass., assignor of one-half to Francke W. Dickinson, same place. Filed Aug. 21, 1897.

601,910. Car-Fender. George O. Spencer, Manchester, N. H. Filed Jan. 4, 1897.

604,944. Street-Car Fender. George H. Smith, Lowell, Mass. Filed Jan. 12, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

601,049. Rheostat for Electric Lamps. Reinhold H. Wappler and Frederick H. Wappler, New York City. Filed Sept. 20, 1897.

605,026. Globe for Incandescent Lamps. Victor de Spruner-Mertz, Brussels, Belgium. Filed Nov. 18, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

604,842. Electric Motor or Dynamo. Andrew L. Riker, New York City. Filed Nov. 24, 1897.

604,843. Former for Winding Armature-Coils. Andrew L. Riker, New York City. Filed Nov. 19, 1897.

MISCELLANEOUS.

604,712. Electrical Signaling System and Apparatus. Walter F. Banks, Milford, Conn., assignor to the National Electrical Manufacturing Company, same place. Filed Oct. 1, 1896.

601,779. Pneumatic Attachment for Telegraph-Keys. William J. Lieb, Pratt, Minn. Filed April 15, 1897.

604,874. Safety Device for Electric Carriages. Reginald T. D. Brougham and Walter C. Bersey, London, England, assignors to the Electrical Vehicle Company, Limited, same place. Filed Dec. 18, 1897.

605,018. Switching Device and Circuit Arrangement for Electrically-Propelled Vehicles. Emil B. W. Retchel, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Jan. 10, 1898.

605,023. Electric Switch for Use With Electrically-Propelled Vehicles or Locomotives, etc. Albion T. Snell and Charles E. Grove, London, England, assignors of one-third to Arnold Frank Hills, same place. Filed Oct. 8, 1897.

DESIGNS.

28,742. Insulator-Plate. William B. McDonald, Chicago, Ill. Filed Dec. 18, 1896.

28,744. Plug for Electrical Purposes. Hiram Percy Maxim, Hartford, Conn. Filed April 9, 1898.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

H. C. Fischer, who has just retired from his position as comptroller of the central telegraph office in London, says he has a lively recollection, when superintendent of the foreign department, of the tremendous excitement in England at certain momentous crises in the American civil war. It was in those days looked upon as a piece of exceptional enterprise that several of the newspapers, in order to be the first to obtain news from America, hired tenders to intercept the mail steamers when approaching Cork harbor. Then would follow a race to be first at the Roches Point telegraph office, whence the messages were telegraphed to the old foreign gallery, and subsequently sent out, sheet by sheet, for publication in the special editions of the London papers. This was of course before the laying of the first Atlantic cable. The war ended in April, 1865, while the laying of the first Atlantic cable was not completed until July 28, 1866. The first cabling done over the line was somewhat expensive, \$100 being charged for twenty words. This rate was reduced about three months afterward to \$50 for twenty words, and the following year it was looked upon as comparatively cheap cabling that a man could send ten words for \$26. That was thirty years ago. The rate is now 25 cents a word.

In regard to ocean cable laying, Mr. Herbert Laws Webb of the New York Telephone Company, who has had several years' experience in the business, says it is a difficult and delicate work and success is not always assured by the best appliances. In a talk with a newspaper representative a few days ago, Mr. Webb said: "When we put in the cable between Cadiz and the Cape Verde Islands the preliminary surveys were not very good, and we had to do most of the surveying over again. Even then when we actually put the cable down we found a submarine mountain previously overlooked, which rose from a depth of some 2,000 fathoms to less than forty fathoms of the surface, a place where a vessel could actually anchor in mid ocean! These submarine mountains are one of the greatest obstacles to successful cable laying. The line is paid out rapidly as it ascends the mountain and falls in festoons and loops when it passes the summit. I remember in one case, which occurred on the west coast of South America, after operating satisfactorily for a time the cable failed. After an extensive investigation it was discovered that a whale had fouled one of these festoons, and in the effort to extricate itself had not only lost its life but had succeeded in wrapping about itself many hundred feet of the cable."

William A. Eddy, who has given much time in the last few years to experiments with kites, has discovered that they can be utilized to advantage in war. At Bayonne, N. J., a few days ago, Mr. Eddy sent up two kites, each seven feet in diameter, and one four feet in diameter, in tandem, piano wire being used. To the piano wire was made fast a thin copper wire, the free end of which was allowed to trail. As the kites ascending raised the point of contact higher into the air and further from the starting point, the copper wire trailed out over trees, houses and barns toward the Kill von Kull, the end of it finally resting on the Jersey shore, where it was secured by Dr. W. H. Mitchell, who was assisting Mr. Eddy in his experiments. To the wire Dr. Mitchell attached a telephone similar to those used in the field. A similar instrument was attached to the kite wire at Mr. Eddy's house, a mile or so away on the base line. Conversation was then had between Dr. Mitchell and Mr. Eddy, the communication being perfect. Mr. Eddy claims that this demonstrates that kites can be used to carry wires for field telephoning in times of war.

"Telegraph operators," says the N. Y. Commercial, "have good cause to bless the obstinacy and ignorance of the Spaniards who forced us into the present war. Such a boom has been given to the telegraph business that an idle operator could not be found with a searchlight. Even superannuated knights of the key are coming out of their retirement in response to the great demand for the services of telegraphists. The primary reason is that the Government requires a small army of operators, and as good wages are paid and the prospects of relief from the monotony of routine work in the cities are alluring, there has been a rush of skilled men to the front and vacancies have been made in the home ranks that give work to every one of the stay-at-homes. Another reason for the demand for operators is that the business of the telegraph companies has been vastly increased by the war conditions."

The farmers of Washington Valley, New Jersey, whose farms are all enclosed by wire fences, have concluded to utilize the fences for telephone purposes. The plan has proved successful in a southern section of the State. An expert electrician will be secured to put the connecting wires in place, which can be done in a few days. The farmers intend to operate one line until they see how it works, and in case the line is a success the valley will soon be a network of telephone wire fences.

President H. Samson of the Home Telephone Company, Pittsburg, Pa., was given a hearing by the committee on corporations on the 27th ult., in regard to an extension of the time set in the franchise granted the company. He said the delays that had occurred were due to contending stockholders outside the city who prevented the work moving on with any celerity. Pittsburgers were now, he said, ready to go ahead with it with \$100,000 back of them. W. J. Rhuland, James Platt and J. M. Heasley were appointed a committee to consider the new ordinance prepared by the Home Company.

There is little danger of any Government secrets regarding war movements leaking from the wires that stretch across the country from Florida to California. The telegraphers, from the highest official to the most subordinate operator, are under the strictest kind of orders not to talk of or discuss in any way for publication anything pertaining to the conflict with Spain. The instructions are just the same as governed the service during the civil war.

The Bell Telephone instrument statement for the month ended May 20 shows: Gross output, 82,441; returned, 11,948; net output, 20,493. The gross output for the same month in 1897 was 20,598; returned, 8,452; net output, 12,146. From December 20, 1897, to May 20, 1898, the gross output was 142,363; returned, 63,645; net output, 78,717. The total outstanding at the latter date was 997,438. The total outstanding May 20 in 1897 was 881,574, in 1896 137,066, in 1895 618,629.

At a recent meeting of the stockholders of the Citizens' Telephone Company at St. Joseph, Mo., Edward S. Newell was elected a director and treasurer of the company to act in the stead of Robert Frazer, who has retired from the company. The condition of the affairs of the company is all that could be desired, and the volume of business done is very satisfactory. It is expected that the success of the past will be greatly exceeded in the future, as new subscribers are being added to the list constantly.

The cash bond of \$5,000 given by the Mississippi Valley Telephone Company to the council at St. Paul, Minn., as an assurance of its good faith in securing its franchise, has been returned to the company, who have furnished a surety bond of \$25,000.

R. B. Rood, who has been resident manager of the Bell Telephone Company in Richmond, Va., for a number of years, has resigned his position. The Richmond Times says of Mr. Rood that he was a hard worker and rose to the position which he has resigned from the ranks, and predicts that there is a greater future ahead of him.

The U. S. Senate on Wednesday last in discussing the War Revenue bill agreed to the committee amendment for a stamp tax on bills of lading, telephone and telegraph messages, etc.

J. W. Shugart, superintendent of construction, and a gang of men have just finished stretching the wire on the telephone line from Round Mountain, Blanco county, Tex., to Llano.

At Chattanooga, Tenn., the two telephone ordinances known as the Coleman and Helvin ordinances have been referred to new committees for report.

The new telephone system in Seaford, Del., is now in operation and in a short time will be connected with those of the other towns on the peninsula.

The Detroit Telephone Company has offered to put 'phones in Windsor, Can., for half the price paid for Bell 'phones.

A war balloon, with all the accessories of telegraphs, telephones, etc., has arrived at Tampa, Fla., and drill in its use will be held at once.

New Companies Incorporated.

The Billings & Musselshell Telephone Company, Helena, Mont. Capital stock, \$5,000. Incorporators: Christian Yegen, L. L. Moffett, George Spencer and George W. Hondle.

The Fergus Falls Telephone Company, Fergus Falls, Minn. Capital stock, \$15,000.

The Easton Telephone Company, Easton, Pa.—to construct lines in Lehigh and Northampton counties, Pa. Capital stock, \$1,000. Directors: E. L. Reinhold, Marietta; William Coyle and George F. Coffin, Easton.

The Hamlin-Huntington Telephone Company, Hamlin, Lincoln county, W. Va.—to erect and maintain telephone lines. Capital stock, \$10,000. Incorporators: R. R. Wilson, O. W. May, R. Sweetland, J. D. Porter, B. B. Curry, J. S. Sweetland, W. W. Baker, all of Hamlin, and J. A. Holly of Charleston.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g. gold, gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—June 3:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q., Feb. '98.	142 1/2	115 1/2
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, '97	66	68
Traction Co. (Saratoga)	100	50,000	50,000			
Allentown, Pa.—June 3:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000		..	15
Bridgeport, Conn.—June 3:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60
Baltimore, Md.—June 3:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97	71	72
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98	23 1/2	23 1/2
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2
Boston, Mass.—June 3:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	..	..
North Shore Traction Co.	100	4,000,000	4,000,000		10	18
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S. A. & O.	72	75
West End Street Ry. Co.	50	10,000,000	9,085,000	1 % S., Oct., '97.	85 1/2	81 1/2
West End Street Ry. Co. 8 % pfd.	50	4,000,000	6,400,000	4 % S., Oct. 1, '97.	104	108 1/2
Boston Elevated R. R.	100	10,000,000	6,400,000		68 1/2	63 1/2
Brooklyn, N. Y.—June 3:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	185	..
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000		41 1/2	42
Brooklyn Heights Railroad	100	200,000	200,000		205	207
Brooklyn City RR. guar.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98	205	207
Brooklyn Queens Co. & Sub. RR.	100	2,000,000	2,000,000		140	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1 1/2 % Oct. 1, '97.	..	..
Kings County Elevated	100	4,750,000	4,750,000		46	17
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	37 1/2
Nassau Electric Railroad	50	6,000,000	6,000,000		..	80
Atlantic Avenue Railroad	50	2,000,000	2,000,000		74	80
Brooklyn B. & W. E. Railroad	..	1,000,000	1,000,000		..	..
Buffalo, N. Y.—June 3:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000		58	60
Buffalo Railway Co.	100	6,000,000	5,370,500	1 % Q. Dec., '97.	79 1/2	81 1/2
Columbus, O.—June 3:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	48	50
Columbus Central Street Railroad	100	1,500,000	1,500,000		..	..
Charleston, S. C.—June 3:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City Ry. Co.	25	1,000,000	250,000		..	..
Chicago, Ill.—June 3:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, '97.	..	250
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800		127 1/2	18 1/2
Lake Street Elevated RR.	100	10,000,000	10,000,000		..	8 1/2
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000		199 1/2	200
Met. West Side El. const. stk.	100	15,000,000	2,500,000		..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., '98.	..	..
North Chicago City RR.	100	500,000	249,000		..	..
South Chicago City Railway	100	2,000,000	1,604,200		93 1/2	94 1/2
West Chicago St. RR. Co.	100	20,000,000	13,189,000	1 1/2 % Q., Feb. '98	..	..
Chicago West Div. Ry. guar.	100	1,250,000	624,900	3 %	..	..
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—June 3:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000		..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2 1/2 %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000		28	25
Windsor Street Ry. Co.	100	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	118
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.	..	..
Cleveland, Ohio.—June 3:						
Acrion, Bed. & Cleve. Elec. Ry.	100	1,000,000	1,000,000	3 % Jan., '98	39	40
Cleveland City Ry.	100	8,000,000	7,600,000	3 %., Oct., '97.	55	60
Cleveland Electric Ry.	100	12,000,000	12,000,000	3 % Q., Oct., '97.	50	58
Detroit, Mich.—June 3:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000		100 1/2	..
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	100	250,000	250,000		..	100
Detroit Electric Railway	100	1,000,000	1,000,000		..	..
Wyandotte & Detroit River Ry.	100	250,000	200,000		100	110
Dayton, O.—June 3:						
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98	140	145
People's Street Railway	..	1,100,000	..		100	..

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad, Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h \$20 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$250,000 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 j 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,000 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—June 3:						
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000	5 % S., Jan., '98.	140	..
Hartford & West Hartford RR.	100	1,000,000	247,000		..	..
Holyoke, Mass.—June 3:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	200	205
Hoboken, N. J.—June 3:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	..
Indianapolis, Ind.—June 3:						
Citizens' Passenger Ry.	..	5,000,000	5,000,000		24	25
Lancaster, Pa.—June 3:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000		..	..
Lancaster & Col. Electric Ry.	..	..	87,500		..	..
West End Street Railway	..	..	..		..	..
Louisville, Ky.—June 3:						
Louisville Ry.	100	4,000,000	3,500,000	1 1/2 %., Oct., '97.	80	85
Louisville Ry. 5 % pfd.	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	87	94
Minneapolis, Minn.—June 3:						
Twin City Rapid Transit Co.	100	17,000,000	15,010,000		14	20
Twin City Rapid Transit Co. 7 % pfd.	..	8,000,000	1,714,200	1 1/2 % Jan., '98.	..	100
Montreal, Canada.—June 3:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S. M. & N.	253	258 1/2
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S. J. & J.	97 1/2	97 1/2
Memphis, Tenn.—June 3:						
Memphis Street Railway Co.	100	500,000	500,000		15	..
New Haven, Conn.—June 3:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	60	..
New Haven Street Railway Co.	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60	80
New Haven & Centerville.	100	700,000	800,000		..	..
Winchester Avenue RR.	25	1,000,000	600,000		40	42
New Orleans, La.—June 3:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	123 1/2	126
New Orleans Traction Co. com.	100	5,000,000	5,000,000		1	2 1/2
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000		5	7
Crescent City RR. guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	30
New Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	88
Orleans Railroad.	50	500,000	185,000	1 1/2 %., June, '94.	16	17
St. Charles Street Railway	50	1,000,000	1,000,000	1 1/2 %., Jan., '98.	58 1/2	64 1/2
New York—June 3:						
Central Cross-town RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	200	..
Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	154	164
Dry Dock, E. B'way & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98	175	195
Metropolitan Street Ry. Co.	100	30,000,000	80,000,000	1 1/2 % Q., Jan., '98.	158	165 1/2
Ellecker St. & Fulton Ry. guar.	100	900,000	900,000	3 % A., July, '97.	32	38 1/2
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	245	212
Gen. Park N.E. Rivers RR. guar.	100	1,800,000	1,800,000	2 1/2 % Q., Jan., '98.	170	170
Eleventh Avenue RR.	100	1,000,000	1,000,000		800	825
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 % Q., Feb., '98.	820	86 1/2
Ninth Avenue RR.	100	800,000	800,000		192	194
Sixth Avenue RR.	100	2,000,000	2,000,000		200	210
Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 % Q., Feb., '98.	810	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	168	171
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	178	180
42d St. Manhat'ly & St. Nich. Av.	100	2,500,000	2,500,000		57	60
Union (Huckleberry) Ry.	100	2,000,000	2,000,000		175	200
Newark, N. J.—June 3:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000		45 1/2	48
Newark Passenger Ry.	100	6,000,000	6,000,000		..	..
Rapid Transit Street Ry.	100	504,000	504,000	11 1/2 % A.	180	190
Pittsburg, Pa.—June 3:						
Allegheny Traction Co.	50	500,000	500,000		..	46
Consolidated Traction Co. com.	50	15,000,000	15,000,000	2 %., Jan., '98.	..	14 1/2
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 %., May, '97.	45 1/2	46 1/2
Central Traction Co.	50	1,500,000	1,500,000		..	..
Citizens' Traction Co.	50	8,000,000	13,000,000	6 % A.	..	..
Duquesne Traction Co.	50	8,000,000	13,000,000	6 % A.	..	..
Pittsburg Traction Co.	50	2,500,000	1,900,000	8 %., Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 %., Jan., '98	23 1/2	..
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,889	2 %., Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	1 1/2 %., Jan., '96.	..	18 1/2
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, '97.	..	..
Second Avenue Traction Co. com.	50	4,000,000	14,000,000		..	..
Suburban Rapid Transit Co.	50	800,000	200,000		..	..

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Cross-town Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent. on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitt's Trac. Co.
 p Leased to Consolidated Traction Company for 8 % per annum on par value of stock.
 q Leased to Fort Pitt Traction Company for 5 % on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4 % on capital stock after October,
 s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorized Issued.	Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock. Authorized Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—June 3:						Boston, Mass.—June 3:					
Union Street Railway Co.....	100	\$250,000 \$250,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000 22,650,000	4% Q. Jan., '98.	274	275
Northampton, Mass.—June 3:						Erle Telegraph & Telephone Co....	100	10,000,000 10,000,000	1% Q. Jan. '98.	128	129
Northampton Street Ry.....	100	800,000 225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	100	10,000,000 10,000,000	1.50%, Feb. '98.	128	...
Omaha, Neb.—June 3:						New York.—June 3:					
Omaha Street Ry.....	100	5,000,000 5,000,000	.....	25	...	American Telegraph & Cable Co....	100	14,000,000 14,000,000	1% Q.	92 1/2	98 1/2
Paterson, N. J.—June 3:						*Central & South Am. Tel. Co.....	100	6,500,000 6,500,000	1% Q.	101	106
Paterson Ry. Co.....	100	1,250,000 1,250,000	.....	85	86	*Commercial Cable Co.....	100	10,000,000 10,000,000	1% Q.	174	175
Providence, R. I.—June 3:						Franklin Tel. Co.....	100	1,000,000 1,000,000	2% guar.	40	44
United Traction & Electric Co.....	100	8,000,000 8,000,000	1/2%, Jan. '98.	59	62	Erle Telegraph & Telephone Co....	100	5,000,000 4,800,000	1% Q.	98	99
Philadelphia.—June 3:						*Gold & Stock Tel. Co. guar. 6%	100	5,000,000 5,000,000	1% Q.	109	111
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000 1,770,000	2%, Dec. '97.	14 1/2	...	*International Ocean Tel. Co. guar. 6%	100	8,000,000 8,000,000	1% Q.	106	108
Hestonville, Man. & Fairmount.....	50	1,966,100 11,966,100	2%, July 15, '97.	42	45	Mexican Telephone Co.....	100	2,000,000 2,000,000	1% Q.	60	65
Hestonville, Man. & Fairmount.....	50	583,900 1,583,900	8% Jan. 10, '98.	61 1/2	65	*New York & New Jersey Tel. Co..	100	5,000,000 3,728,000	1% Q. Jan., '98.	142	145
aFairmount Pk. & Had. Pass. Ry.....	50	800,000 800,000	3% Feb. 1, '98.	68	66	*Pacific & Atlantic Tel. guar. 4%	25	2,000,000 2,000,000	2% S.	78	78
Union Traction Co.....	50	30,000,000 23,930,450	16% 16 1/2	71 1/2	71 1/2	*Postal Telegraph Cable Co.....	100	15,000,000 15,000,000	1% Q.	...	...
aElectric Traction Co.....	50	8,297,920 8,297,920	11% 11 1/2	71 1/2	71 1/2	*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000 559,525	2% S.	85	...
aCitizens' Passenger Ry.....	50	500,000 500,000	8 share Q.	275	...	*Commercial Union Telegraph Co....	25	500,000 500,000	3% S. Jan. 1 '98.	111	113
aFrankford & Southwark Pass. Ry.	50	1,000,000 1,000,000	11 share A—Apr. 97	140	...	Western Union Telegraph Co.....	100	97,870,000 97,870,000	1 1/2% Jan., '98.	92 1/2	92 1/2
aLehigh Avenue Ry. Co.....	50	1,000,000 1,000,000	8 share A, Mar. 97	47	...	Miscellaneous.—June 3:					
aLombard & South Street Ry.....	25	1,000,000 1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000 400,000	1% Q. Feb. '98.	14	...
aSecond & Third Streets Ry.....	25	1,000,000 1,000,000	8 share A, Mar. 97	35	246	Bell Teleph. Co. (of Canada).....	100	8,168,000 8,168,000	2% S.	170 1/2	178
aPeople's Traction Co.....	50	10,000,000 16,000,000	3% A., April, '97.	185	185	Chesapeake & Potomac Tel. Co....	100	.....	.....	48	...
aGermantown Passenger Ry.....	50	1,500,000 1,500,000	3% Jan. 1898.	135	...	Chicago Telephone Co.....	100	.....	.....	202	...
aGreen & Oates Passenger Ry.....	25	1,500,000 1,500,000	3% Jan. 1898.	135	...	Central Dist. Prtg. & Tel. Co. (Phg.).	100	750,000 750,000	.....	68	76
aPeople's Passenger Ry.....	25	1,500,000 1,500,000	3% Jan. 1898.	135	...	Empire & Bay States Telegraph Co.	100	.....	.....	71	78
aPeople's Passenger Ry.....	25	1,500,000 1,500,000	3% Jan. 1898.	135	...	Hudson River Telephone Co.....	100	2,000,000 2,000,000	1% Q.	112	117
aPhiladelphia Traction Co.....	50	30,000,000 20,000,000	4% S—Oct. 1, '97.	83	83 1/2	*Northwestern Telephone Co. guar.	50	2,500,000 2,500,000	3/4% Q.	87 1/2	122
aCatherine & Bainbridge St.....	50	1,000,000 1,000,000	6% A—Mar. '97.	185	...	Providence (R. I.) Teleph. Co.....	50	.....	.....	87 1/2	122
aContinental Pass. Ry. guar.....	50	1,000,000 1,000,000	6 share—July, '97.	185	...	Southern New Eng. Teleph. Co.....	100	8,000,000 8,000,000	.....	120	122
aEmpire Passenger Ry. Co.....	50	600,000 600,000	.....	180	...						
aPhiladelphia City Pass. Ry.....	50	1,000,000 1,000,000	7.50 share July '97	175 1/2	180						
aPhiladelphia & Gray's Ry. R.R.....	50	1,000,000 298,650	8.50 share July '97	86	300						
aRidge Avenue Passenger Ry.....	50	750,000 750,000	12 share July '97	275	300						
aPhiladelphia & Darby Ry. guar.....	50	1,000,000 1,000,000	8 share July, '97.	185	...						
a17th & 19th Sts. Pass. Ry. guar.....	50	1,000,000 1,000,000	1% S., July, '97.	185	...						
aThirteenth & 15th Sts. Pass. Ry.....	50	1,000,000 1,000,000	1% S., July, '97.	185	...						
aUnion Passenger Ry. Co.....	50	1,500,000 1,500,000	8.50 sh. July '97	220	228						
aWest Philadelphia Pass. Ry.....	50	750,000 750,000	10 share, July '97	280	285						
Rochester, N. Y.—June 3:											
Rochester Railway Co.....	100	5,000,000 5,000,000	.....	16	18						
Reading, Pa.—June 3:											
aReading Traction Co.....	50	1,000,000 1,000,000	Semi-an., Jan. & Jy	15	...						
aCity Passenger Ry.....	50	850,000 850,000	Jan., '98.	112	...						
aEast Reading Electric Ry.....	50	1,000,000 1,000,000	Jan., '98.	64	...						
St. Louis Mo.—June 3:											
Fourth Street & Arsenal Ry.....	50	800,000 150,000	2% Dec., 1898.	...	...				
Jefferson Avenue Ry. Co.....	50	400,000 400,000	1% Jan., '98.	122 1/2	125						
Lindell Ry.....	100	2,500,000 2,400,000	1 1/2% Jan., '98.	122 1/2	125						
National Railway Co.....	100	2,500,000 2,479,000	1 1/2% Jan., '98.	122 1/2	125						
Case Avenue & Fair Grounds.....	100	2,500,000 2,500,000	1% Oct., '98.	90	110						
Citizens' R.R.....	100	2,000,000 1,500,000	1% Oct., '98.	90	110						
St. Louis R.R.....	100	2,000,000 2,000,000	1 1/2% Jan., '98.	95	105						
Missouri R.R.....	50	2,400,000 2,300,000	1 1/2% Jan., '98.	170	172 1/2						
People's R.R. Co.....	50	1,000,000 800,000	50c., Dec., '89.	57	70						
Southern Electric Ry.....	100	1,000,000 1,000,000	1 1/2% Jan., '98.	108	110						
Southern Electric Ry.....	100	1,000,000 1,000,000	1 1/2% Jan., '98.	55	56						
St. Louis & Suburban Ry.....	100	2,500,000 2,500,000	3% A., July, '98.	175	...						
Union Depot R.R.....	100	4,000,000 4,000,000	3% A., July, '98.	175	...						
San Francisco, Cal.—May:											
California St. Cable R.R.....	100	1,000,000 600,000	50c. monthly.	40	50						
Geary Street Park & Ocean R.R.....	100	1,000,000 875,000	\$2.50 share, '96.	52 1/2	63						
Market Street Ry.....	100	18,750,000 18,750,000	Q., 60c. per share.	52 1/2	63						
Presidio & Ferries R.R.....	100	1,000,000 550,000	.....	8 1/2	...						
Scranton, Pa.—June 3:											
Scranton Railway Co.....	50	6,000,000 2,500,000	.....	10	12						
aScranton & Carbondale Trac. Co..	100	1,050,000 500,000	.....	18	...						
aScranton & Pittston Traction Co..	100	1,050,000 1,050,000	.....	18	...						
Springfield Ill.—June 3:											
Springfield Consolidated Ry.....	100	750,000 750,000	.....	11	...						
Springfield O.—June 3:											
Springfield Street Ry.....	100	1,000,000 1,000,000	.....	2	...						
Springfield, Mass.—June 3:											
Springfield Street Ry.....	100	1,200,000 1,166,700	8% A.	206	210						
Toronto Canada.—June 3:											
Toronto Ry. Co.....	100	6,000,000 6,000,000	1 1/4% S.	97 1/2	97 3/4						
Montreal Street Railway Co.....	100	4,000,000 4,000,000	4% S.	258	258 1/2						
Washington, D. C.—June 3:											
Belt Ry. Co.....	50	500,000 500,000	.....	73 1/2	74 1/2						
Capital Traction Co.....	100	12,000,000 12,000,000	65c. per sh. Oct. '97.	75	78						
Columbia Ry. Co.....	50	400,000 400,000	6% A.	8	...						
Eckington & Soldiers' Home Ry.....	50	707,000 652,000	.....	8	...						
Georgetown & Tenallytown Ry.....	50	200,000 200,000	2 1/2% Q.	119 1/2	120 1/2						
Metropolitan R.R. Co.....	50	1,000,000 453,930	2 1/2% Q.	119 1/2	120 1/2						
Worcester, Mass.—June 3:											
aWorcester Traction Co.....	100	8,000,000 8,000,000	.....	15	17						
aWorcester Traction Co.....	100	2,000,000 2,000,000	8% S., Feb., '98.	92	94						
Worcester & Suburban Street Ry.....	100	550,000 542,500	4% S., 1897.	84	...						
Wilkesbarre, Pa.—June 3:											
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000 5,000,000	1% Jan., '97.	24	29						

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. (Electric, People's and Philadelphia Traction companies. Fixed charges
 and all indebtedness of constituent and leased companies assumed by Union Traction Com-
 pany.
 c Practically all shares owned by Union Traction Company.
 d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 e Leased to Electric Traction Company.
 f Controlled by Frankford & Southwark Passenger Railway.
 g Leased to People's Passenger Railway at \$5 per share.
 h Majority of stock owned by People's Traction Company.
 i Leased to Union Traction Company.
 j Lease transferred to Union Traction Company.
 k Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in
 1899-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a divi-
 dend semi-annually.
 l Dividend of 10% guaranteed by Reading Traction Company.
 m Dividend of 6% guaranteed by Reading Traction Company.
 n Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—June 3:											
Fort Wayne Electric Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	.....	.....	.....	.....	.....	.....	.....	.....	36 1/2	36 3/4
General Electric Co.....	100	40,000,000	30,460,000	2 1/2 % Q., Aug., 1898.	.....	.....	.....	.....	.....	90	95
General Electric Co.....	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	.....	.....	.....	.....	.....	8 1/2	8 3/4
T.-H. Elec. Co. T. Secur., Series D.	50	.....	146,700	.....	.....	.....	.....	.....	.....	22	23
Westinghouse Elec. & Mfg. Co. com.	50	.....	.....	.....	.....	.....	.....	.....	.....	52	53
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 1/2 % Q., Feb., '98.	.....	.....	.....	.....	.....	.....	.....
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	.....	.....	.....	.....	.....	.....	.....
New York.—June 3:											
Edison Elec. Ill'g Co., New York..	100	10,000,000	7,988,000	.....	.....	.....	.....	.....	.....	125	182
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2 % Oct., '97.	.....	.....	.....	.....	.....	107 1/2	107 1/2
Edison Ore Milling Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	10	13
Edison Electric Storage Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	24 1/2	26
General Electric Co.....	100	40,000,000	30,460,000	2 1/2 % Q., Aug., 1898.	.....	.....	.....	.....	.....	36 1/2	36 3/4
General Electric Co.....	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	.....	.....	.....	.....	.....	90	95
Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	.....	.....	.....	.....	.....	41	.....
United Elec. Lt. & Pow. Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg, Pa.—June 3:											
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	.....	.....	.....	.....	.....	127	.....
East End Electric Light Co.....	50	800,000	800,000	Q.	.....	.....	.....	.....	.....	10	.....
Philadelphia, Pa.—June 3:											
Edison Electric Light Co.....	100	2,000,000	.....	.....	.....	.....	.....	.....	.....	144 1/2	.....
*Electric Storage Battery Co. com.	100	8,500,000	.....	.....	.....	.....	.....	.....	.....	21 1/2	23
*Electric Storage Battery Co. pfd.	100	5,000,000	.....	.....	.....	.....	.....	.....	.....	24 1/2	26
*Penna. Ht., Lt. & Pow. Co.	50	5,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
*Penna. Ht., Lt. & Pow. Co.	50	5,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northern Elec. Light & Power Co..	10	650,000	550,000	3 1/2 % Oct., '97.	.....	.....	.....	.....	.....	13 1/2	14
Southern Elec. Light & Power Co..	10	187,500	187,500	\$82500 dis. Jan. 11 '97	.....	.....	.....	.....	.....	10	.....
Miscellaneous.—June 3:											
Brush Electric Co.....	50	.....	.....	.....	.....	.....	.....	.....	.....	7 1/2	40
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	.....	.....	.....	.....	.....	13	18
Missouri-Edison (St. Louis).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eddy Electric Mfg. Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hartford (Conn.) Elec. Light Co.....	100	850,000	.....	.....	.....	.....	.....	.....	.....	125	128
Hartford (Conn.) Lt. & Power Co..	25	175,000	.....	.....	.....	.....	.....	.....	.....	6	11
New Haven (Conn.) Elec. Lt. Co.....	100	100,000	.....	.....	.....	.....	.....	.....	.....	60	.....
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	.....	.....	.....	.....	.....	.....	83 1/2	85
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	110	120
Royal Elec. Co. (Montreal).....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17 1/2	154
Toronto (Canada) Elec. Light Co.....	100	1,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Thomson-Houston Welding Co.....	100	1,085,000	1,085,000	2 1/2 % Q.	.....	.....	.....	.....	.....	.....	.....
Woonsocket (R. I.) Electric Co.....	100	.....	.....	1 1/2 % S., Dec. 1, '96.	.....	.....	.....	.....	.....	.....	.....
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	10	100

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.	NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.						Authorized.	Issued.				
Albany, N. Y.							New Orleans La.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	.....	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1980	J. & J.	*111	.....	Crescent City RR. 1st mtg. 6s.	.....	50,000	1899	M. & N.	101	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....	Crescent City RR. Cons. mtg. 5s.	5,000,000	8,000,000	1943	J. & J.	75%	77
Watervliet Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117%	.....	New Orleans City RR. 1st mtg. 6s.	415,500	899,000	1903	J. & D.	104	111
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	N. Orl's City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98%	99%
Troy City Railway Co. 1st mtg. 5s.	.....	.....	.....	.....	*105	106%	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	110	.....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.							Oreosent Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	9%	100
							St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	.....
							\$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$90,000 outstanding.						
Baltimore Md.							New York.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	.....
Baltimore Trac. Co. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102%	103	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	105	109
Bal. Trac. Co. No. Balto. div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114%	115	Broadway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	103	120%
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101%	.....	Broadway & 7th Ave. 1st mtg. 5s.	1,500,000	500,000	1904	J. & D.	106	110
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	108%	.....	Broadway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....	Broadway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*115	117
Central Pass. Ry. Co. Cons. mtg. g. 5s.	601,000	580,000	1982	M. & N.	118	116	Broadway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1906	.....	*107	110
City & Suburban Ry. 1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	113%	114%	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	118	115
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	118	116
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119%	Brooklyn Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. \$151,000 in escrow to retire 1st mtg. bds.							Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	95	.....
							Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	8,500,000	8,500,000	1941	J. & J.	103	106
							Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
							Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	95	.....
							Bleeker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1906	.....	103	107
							Cent Pk. N. & E. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	110	118
							Central Croastown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
							Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	108	106
							2d Dock, E. Bd'y & Bat'y RR. gen. mtg. g. 5s.	1,000,000	930,000	1932	J. & D.	114	117%
							Dry Dock, E. Bd'y & Bat'y RR. scrip 5%	1,100,000	1,100,000	1914	F. & A.	100	*108
							Eighth Av. RR. Co. Cert. indebt. 6%	1,000,000	1,000,000	1914	F. & A.	104	.....
							12d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	114	116
							12d St., Man. & St. N. Av. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	80	83
							Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	M. & S.	117%	.....
							Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1937	F. & A.	113	.....
							Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
							Second Avenue Ry. Deb. 5s.	300,000	300,000	1909	J. & J.	106	.....
							Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
							South Ferry RR. Co. 1st mtg. 5s.	350,000	350,000	1919	.....	106	111
							Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	100	121
							Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
							Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108
							Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111%	114
							Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....
							\$1,085,000 in escrow to retire gen. mtg. bonds.						
							\$14,850,000 in escrow to retire maturing obligations.						
							\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
							In treasury, \$90,000.						
							Guar. by Union Ry. Co.						
Charleston S. C.							Toronto Canada.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....	Montreal St. Ry. 1st mtg. 6s.	2,500,000	800,000	1909	M. & S.	.....	.....
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....	Toronto St. Ry. 1st mtg. g. 4s.	4,650,000	2,200,000	1921	M. & S.	.....	.....
Controlled by Charleston St. Ry. Co.							\$85,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.						
Chicago Ill.							Philadelphia.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
Chicago City Ry. 1st mtg. 4s.	6,000,000	4,619,500	1901	J. & J.	101%	102%	Continental Pass. Ry. 1st mtg. 6s.	850,000	310,000	1909	J. & J.	.....	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103%	.....	Empire Pass. Ry. 1st mtg. 7s.	800,000	300,000	1900	J. & J.	.....	.....
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....	Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....	Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	.....	1901	.....	.....	.....
Chicago & So. Side R. T. 2d mtg. g. 5s.	1,500,000	750,000	1907	J. & J.	.....	.....	People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4s.	4,040,000	4,040,000	1932	J. & J.	104%	.....	People's Pass. Ry. 2d mtg. 6s.	500,000	158,000	1911	J. & J.	.....	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	6%	70	People's Pass. Ry. Cons. mtg. 5s.	1,125,000	367,000	1912	M. & S.	.....	.....
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	45	48	People's Pass. Ry. Stk. tra. cert. g. 4s.	5,698,210	.....	1943	.....	101	102
North Chicago St. RR. 1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	104	105	Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....
North Chicago St. RR. Cert. indebt. 6s.	500,000	500,000	1911	J. & J.	.....	103	Philadelphia Trac. Co. Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	104	105
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....	Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1908	A. & O.	.....	.....
North Chicago City Ry. consol. 4s.	2,500,000	2,500,000	1927	M. & N.	105	.....	Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....
West Chicago St. RR. 1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	103	104	Union Traction Co. Coll. tr. 4s.	29,735,000	29,724,875	1945	A. & O.	.....	.....
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100%	100%	West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1986	.....	90%	91%	West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115%	.....
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....	West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114%	115
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chi. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.							The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Cincinnati, O.							Pittsburg, Pa.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101	Birmingham, Knox & Allentown. 6s.	500,000	500,060	1931	M. & S.	8%	91
Mt. Adams & Eden Pk Inc. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	111	.....	Central Traction Co. 1st mtg. 5s.	875,000	875,000	1930	J. & J.	.....	.....
Mt. Adams & Eden Pk Inc. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	.....	.....	Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,700	531,000	1906	M. & S.	.....	108%	*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108%	109
So. Cov. & Cin. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	.....	119	*Fed' 1st. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1910	J. & J.	.....	.....
So. Cov. & Cin. St. Ry. 2d mtg. 6s.	400,000	400,000	1982	J. & J.	129%	.....	Fed' 1st. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1910	J. & J.	107%	.....
Assumed by the Cincln. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.							Milvale, Etna & Sharpesburg. 5s.						
							Pittsburg, Crafton & Mansfield. 5s.						
							Pittsburg Traction Co. 1st mtg. 5s.						
							Pittsburg & Birmingham. 1st mtg. 5s.						
							Pittsburg & West End. 1st mtg. 5s.						
							Pgh., Allegh. & Manch. Gen. mtg. 5s.						
							Second Ave. Traction Co. 5s.						
							Sub. Rapid Transit Railway Co. 6s.						
Cleveland, O.							Providence R. I.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
aBrooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1908	M. & S.	105	107	Newport Street Ry. Coupon 5s.	50,000	50,000	1910	J. & D.	.....	.....
Cin. New. & Cov. St. Ry. Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101	United Trac. & Elec. Co. 1st mtg. g. 5s.	9,000,000	8,247,000	1938	M. & S.	105	117
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104%							
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1918	M. & S.	100	103							
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	101%	103							
aEast Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	.....	.....					
Fr. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	.....	.....					
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....					
St. Ry. Co. (Grand Rapids) 1st mtg. 5s.	600,000	600,000	1912	J. & D.	.....	.....					
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.													
Detroit, Mich.													
Date of Quotation—June 3, 1898.													
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,885,000	1905	A. & O.	96%	99							
Fr. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	.....	.....					
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100							
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.													
New Haven Conn.							St. Louis.						
Date of Quotation—June 3, 1898.							Date of Quotation—June 3, 1898.						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	.....	Baden & St. Louis RR. 1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	101
New Haven (Edgewood Div.) 1st mtg. 6s.	250,000	250,000	1914	J. & D.	104	.....	Cass Ave. & Fair Gds. Ry. 1st mtg						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bld.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—June 3, 1898.						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry. 1st mtg. 6s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co. 1st mtg. 6s.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri R.R. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	107
†Mound City R.R. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's R.R. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
†People's R.R. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97%	100
People's R.R. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis R.R. Co. 1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100%	101%
†St. Louis & Sub. Ry. 1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100%	101%
St. Louis & Sub. Ry. Income 5s.	800,000	800,000	.....	.....	60	64
†Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
†Taylor Avenue St. Ry. 1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot R.R. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot R.R. Co. Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis R.R. Co.						
†Controlled by Union Depot R.R. Co.						
†Controlled by Lindell R.R. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—May, 1898.						
California St. Cable R.R. 1st mtg. g. 6s.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean R.R. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	127	129½
†Metropolitan Ry. Co. 1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127%	130
†Park & Cliff House R.R. 1st mtg. 6s.	850,000	850,000	1912	J. & J.	10½	10½
†Park & Ocean R.R. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	117%	120
†utter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109%	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—June 3, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	150,000	1920	J. & J.	45	.....
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	11%	.....
Eckington & Soldiers' Home. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	96	100
Metropolitan R.R. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117%	119%
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—June 3, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,683,000	1928	J. & J.	100	105
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	110	112
†Citizens' St. R. (Ind. polis) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	79	80
†Croswell St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry. 1st cons. m. g. 5s.	8,000,000	2,251,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	108
†Croswell St. Ry. (Colu's O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,981,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	489,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
†Pecheater (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	96	.....
St. Paul City Ry. 1st cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	86	92
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. R.R. Co.						
†\$87,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$320,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—June 3, 1898.						
Edison Elec. Illuminating Co., Boston	2,026,000	.....	1922	Quar.	156	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	.....	.....	104	.....
Pittsburg, Pa.						
Date of Quotation—June 3, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	106	.....
Allegheny City Electric Light Co. 1st mtg. 6s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip. 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(June 3, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,155,000	1938	.....	11%	.....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 6s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1905	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—June 3, 1898.						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100%	.....
Northwestern Telephone Co. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108%	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—June 3, 1898.						
American Electric Heating Co. 5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. 5s.	.....	.....	.....	.....	.....	25
†Barney & Smith Car Co. 7s.	.....	.....	1942	J. & J.	96	100
†Carborundum Mfg. Co. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	71,890	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11¾c.; Lake, 11.90@12.10c. casting, 11¾c.

The first mortgage coupons of the Second Avenue Traction Company of Pittsburg, due June 1, will be paid at the banking firm of Brown Brothers & Co., New York, and Alexander Brown & Sons, Baltimore.

The Brooklyn & Brighton Beach Railroad Company reports for the quarter ending March 31 a deficit, after fixed charges, of \$15,854, against a deficit last year of \$14,412.

The Federal Court at Milwaukee has decided the suit for a reduction of Milwaukee street car fares to four cents in favor of the roads. The suit was aimed particularly at the Milwaukee Electric Railway & Light Company.

Standard Underground Cable, which pays 6 per cent. per annum with commendable regularity, to use the words of the Boston "News Bureau," advanced \$2 per share last week to 107 bid.

The Western Union Telegraph Company's Central Cable Office announces that the Government has removed the restrictions as to code and cipher messages for Venezuela and Brazil.

The Boston "News Bureau" corrects the statement that for the year ending June 30 next the earnings of the Boston Electric Light Company would show 13 per cent. on \$25,000 share capital. The earnings would show 13 per cent. on the outstanding capital of \$1,700,000 and not on the increased capitalization of \$2,500,000.

By authority of the stockholders of the Hartford (Conn.) Electric Light Company, the board of directors has voted to increase the capital of the company by the addition of \$100,000 to its present capital of \$400,000. This is the limit allowed by the Legislature and will bring the capital up to half a million dollars. The increase is offered to the present stockholders on the basis of one share to every four now held. The directors decided to call for two payments from subscribers—one-half on July 5 and the remaining half on October 5. The subscription books will be opened at the office of Henry H. Skinner, Phoenix Bank Building, Hartford, Conn., on June 15.

The annual report of the Twin City Rapid Transit Company, according to the St. Paul "Pioneer Press," shows a decrease in gross earnings of \$50,000, which is 2.43 per cent. Operating expenses increased \$6,922 and net earnings decreased \$57,019. The total receipts amounted to \$2,009,120.98, as compared with \$2,059,218 the year before; total operating expenses, \$1,002,080.38, as compared with \$995,158; net earnings, \$1,007,040.60, as compared with \$1,064,059. The surplus earnings were \$235,133.74. The balance sheet of assets and liabilities foots up at \$29,754,790.93.

The North Chicago Street Railroad Company has given notice that it will retire \$500,000 of 6 per cent. debentures beginning July 23. It was this issue which it was determined to take up when the recent increase in capital stock was voted. That increase amounted to \$1,320,000. The debenture issue to be bought in was put out in January, 1891. The certificates were 5-20s. so that they have been redeemable since 1890. They will be retired at par and accrued interest to July 23, 1898.

A dispatch from Chicago states that the Union Transit Company intends to petition the city council for a fifty-year franchise for 20 miles of trolley in 30 streets and alleys of the South Side, with a down-town terminal at Jackson Boulevard and Pacific avenue. From this point the route as given cuts diagonally across the South Side to Sixty-seventh street and Woodland avenue. Lucius Clark of General Electric Railway fame is said to be president of the new company.

The Coney Island & Brooklyn Railway Company, which includes the Brooklyn City & Newtown Railroad, reports for the quarter ended March 31: Gross earnings, \$215,892; operating expenses, \$156,121; net earnings, \$59,771; other income, \$305; total income, \$60,076; charges, \$52,728; surplus, \$6,348. In 1897 the gross earnings were \$186,441; operating expenses, \$130,157; other income, \$2,601; total income, \$58,885; charges, \$45,153; surplus, \$13,732.

A first mortgage given by the Herkimer County Light & Power Company of Herkimer, N. Y., to the Continental Trust Company of the city of New York for \$400,000 was recorded in the county clerk's office at Ilion last week. The mortgagors are the company who recently purchased the gas and electric plants at Little Falls, Herkimer, Mohawk and Ilion. The mortgage recites that at the time of the consolidation of these companies the Herkimer Company had outstanding certificates and items of indebtedness amounting to \$60,000, the Little Falls company \$190,000 and the Ilion company \$75,000. The mortgage is made to secure four hundred \$1,000 bonds, dated May 2, 1898, payable in gold thirty years from date with interest at the rate of 5 per cent., payable semi-annually.

The annual meeting of the Electric Storage Battery Company was held at Gloucester, N. J., on the 1st inst. The old directors were re-elected. President Rice, in his report, said that notwithstanding the great detriment to the company's business caused by the declaration of war, sales for five months from January 1 were \$314,488, against \$241,077 for the same period of 1897. Manufacturing profits in 1895 were \$15,096; in 1896, \$141,998; in 1897, \$325,290. President Rice said that the reason no dividend had been declared was that patents acquired and experimental demonstration had required cash, which had been taken from earnings. If 1898 results equaled 1897, the company would be in a position to consider dividends beginning in 1899.

Mr. Richard H. Rushton, the active head of the Fourth Street National Bank, Philadelphia, says there should be no fears of any developments in the money market adverse to public interests. He says: "There is plenty of money—indications of that are to be found on every hand. And among the holders and owners of money the same confidence that is increasing new business activity and putting up security prices is driving away all fears that may have existed, and making more and more general the disposition to loan freely and at low rates."

The consolidation of the City Passenger and Central Railway systems by the purchase of the Central lines places the street railway service of Baltimore practically under the control of two corporations, the Baltimore City Passenger and the Consolidated Railway companies. The City Passenger Railway Company formerly operated about sixty miles of track, which was increased to 107 miles by the absorption of the Central Railway Company, and will be further increased six and one-half miles when extensions now under construction are completed.

The New Haven "Palladium" offers a few remarks on corporations which, as they relate to lighting plants and street railroads, appear to us timely and reasonable. It says: "One of the subjects to be discussed at the Convention of the League of American Municipalities in Detroit is the remuneration to cities for local franchises, and the discussion ought to result in dissipating a great deal of the talk about municipal ownership and management of lighting plants and street railroad lines. Corporations controlling such interests now are often denounced as monopolies, but where they are compelled to pay a suitable annual compensation to municipalities based on earnings they cease to be monopolies. If earnings increase from any cause the public as well as the corporations profit, and where this is the case the privileges of the latter cannot be called exclusive. If corporations should attempt to wring from the public more than fair compensation for the services they perform it would only be to hand back part of such gains to the public again. The cure for local monopolies, therefore, is in exacting a proper return for municipal franchises. Corporations would not then be at the mercy of political bosses and the community would enjoy all the advantages of municipal control without any of its risks and responsibilities. It is to be hoped that the discussion at the Detroit convention will result in making such facts clearer than they have been heretofore."

ELECTRICITY.

Vol. XIV.

NEW YORK, JUNE 13, 1898.

No. 23.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter,

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Editorial Notes,	353-354
Submarine Cable Cutting.	
The National Electric Light Convention.	
Changes in the Patent Office.	
Under the Searchlight,	354
Is this Another General Electric Scheme?	
The Chicago Convention,	355
President Insull's Address.	
Abstracts of the Papers Read.	
Report of the Committee on Standard Candle-Power of Incandescent Lamps.	
The New Officers.	
List of Attendants.	
Midsummer Meeting of the Northwestern Electrical Association,	360
On the Steamer North West.	
List of Members and Guests.	
Illinois Street Railway Association,	360
Personal—Convalescence of Lieut. Frank J. Sprague,	360
The X-Rays and their Safe Application. By J. Mount Bleyer, M. D.,	361
New Electrical Thermometer,	361
Canadian Notes,	362
Legal Notes,	362
The News,	363
Lighting Plants—Street Railways—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Commercial Paragraphs,	364
Incorporations,	364
Electrical Patent Record,	364
Telephone and Telegraph,	364
Electrical Securities—Stocks, Bonds, Etc.,	365
Notes for Investors,	368

EDITORIAL NOTES.

Submarine Cable Cutting.

As Mr. C. C. Mattison aptly said at a recent meeting of the Chicago Electrical Association, "Of all the uses of electricity in warfare it seems to me that the electric telegraph is the most valuable." This statement is undoubtedly to a great extent true. The shutting off of an enemy from outside communication has always been an important factor in war. Before the first ocean cable was laid it was only necessary to destroy or block the adversary's ships. Now, however, things are very different, and although a harbor may be blockaded and all communication through ordinary courses with the outer world cut off, still communication may be carried on and reinforcements asked for by means of a submarine cable. In our present war with Spain a number of these cables have been cut, and undoubtedly more will share the same fate. The question has been brought up as to whether this country has the right to cut cables that are not controlled by American companies, but which afford the enemy means of communicating with the outer world and with its home government. The point brought up is unquestionably a legal one, but it would seem as though a neutral country ought to refuse to transmit war messages to the home government of, for instance, a besieged colony. The messages transmitted would probably be of far more importance than the furnishing of coal to a warship of one or other of the belligerents. However this may be, the United States has out a number of cables running out from Cuba, leaving the question of damages, if any are claimed by neutral countries, to be settled hereafter in court.

It may interest some of our readers to know that the first submarine cable of any length was laid across the Straits of Dover between Calais and Cape Grinez in 1847. This cable was very crude in its manufacture, consisting only of a copper conductor surrounded by an insulating layer of gutta percha, and consequently failed a few hours after having been put in place. In 1858 the first cable across the Atlantic was laid between Ireland and Newfoundland. As will be remembered by many, this cable proved defective, ultimately failing through excessive leakage. Another attempt was made to lay a cable between the Old and New World in 1865, resulting in its breaking in deep water. The following year, however, through the medium of a third cable, communication was successfully established.

As is well known, a submarine cable consists of a conductor of stranded copper wire, the insulation usually consisting of layers of gutta percha, a bedding of jute and an external sheathing of iron wires covered by suitably prepared tape. The latter wind-

ing goes to make up the protecting covering and prevents the stranded copper conductor from becoming exposed through abrasion. It was principally through this lack of proper insulation and sheathing that the first cables that were laid failed. The thickness of the sheathing varies with the depth at which it is proposed to lay a cable. What are known as deep sea cables are lightly sheathed with slender steel wires. Shore end cables, on the other hand, which rest upon rocky bottoms and are more or less subject to the action of storms and heavy tides, are heavily armored.

As soon as it becomes apparent that signals can no longer be transmitted through a cable it is necessary to accurately locate the break in order to repair it. This is done by measuring the electrical resistance of the conductor, usually from each end. Knowing what the resistance in ohms per mile is of the conductor in that special cable, the distance in miles to the break can readily be computed. Thus when Admiral Dewey cut the Manila cable it was immediately ascertained at Hong Kong that the cable was parted some forty miles from Manila.

The grappling for and cutting of a submarine cable are by no means a simple matter unless the ship undertaking this work is provided with all the necessary apparatus. A ship of war usually relies upon what is known as the cutting grapnel to destroy a cable unless it is desired to utilize one section of a cut cable for communicating purposes. In such an event the cable after being caught in an ordinary grapnel is brought on board the ship, where it is severed, the end in control of the enemy being securely fastened to a buoy and dropped overboard. Through the other end messages may be transmitted wherever desired providing the vessel is equipped with suitable transmitting and receiving apparatus. When it is merely desired to part a cable in deep water a cutting grapnel is lowered and the vessel steams slowly backward and forward at right angles to the line of cable. As soon as the latter is hooked it slips, by means of pulleys, between two heavy knives or teeth and the strain in lifting causes the teeth to close and bite off the cable.

The recent cable cutting at the harbor of Cienfuegos was accomplished in a very different manner. In this case the cable to be cut was in shallow water. It had to be grappled for by small boats and when caught hauled up across them. It was absolutely necessary to cut a section many feet in length out of the cable to prevent the ends being spliced later by the Spaniards and communication re-established. This work had to be done under the most adverse circumstances, the tough steel wires forming the armor being hacked off with axes, chisels and saws.

Probably the most important lesson that the present war has taught, so far as submarine cables are concerned, is that every man-of-war should not only

be provided with all the necessary tools for cable cutting, but should also have on board a mirror galvanometer and other necessary instruments for the transmission of messages. This would also necessitate the presence on a war vessel of at least one or two skilled telegraphic operators just as each war vessel now carries a number of expert divers.

* * *

The National Electric Light Association, by far the most important gathering of the year in electrical circles, has met, done its work and dispersed.

The meeting was unquestionably the most successful that has yet been held. Heretofore considerable fault has been found with the National Electric Light Association for not accomplishing more of a practical nature. Through the efforts of Mr. Insull, this criticism would be unfounded if applied to the late Convention, as the papers presented were almost invariably on sound practical subjects and the discussions were conducted in the true didactic spirit. The attendance was unusually large, there being present by far a greater number of central station men than ever attended any previous National Electric Light Convention. In former years the supply men and manufacturers' representatives have predominated, but at the Chicago Convention the central station element outnumbered all others. And this is as it should be, as the Association is presumed to be mainly composed of central station representatives.

This excellent showing of practical men is directly due to the efforts of President Insull, who, himself president of one of the largest central stations in the country, took particular pains and spared no efforts to secure the attendance at the Convention of many central station men who had never previously attended a meeting of the Association. The result of having such a large number of eminently practical men present naturally had its effect on the discussions, tending to make them of an instructive nature and bringing out points actually met with in practice that could have been touched upon understandingly by no other set of men.

The social features were everything that could be desired and most enjoyable, and certainly spoke well for the hospitality to be met with in the "Windy City." The ladies present went on two coaching parties, but unfortunately the enjoyment of the drives was somewhat marred by sudden showers.

The proceedings of the Convention will be found in detail elsewhere in this issue, and we trust that the eminently practical papers read and topics discussed at the Chicago meeting will serve as a precedent for future gatherings of the Association.

* * *

Changes in the Patent Office.

It will interest inventors in general, and electrical inventors in particular, to know that provision has been made for increasing the number of Patent Office examiners. The electrical department of the Patent Office in Washington has always been more or less behindhand in its work of passing upon applications, and has probably never been more so than at the present time. The bill was passed on June 6 by the House of Representatives by a vote of 154 to 58 which calls for the revising and classification of letters patent. By the provisions of the bill the Patent Office is to have an enlarged force for clerical work, by whose assistance it will be possible to relieve the congested condition of affairs which now exists in that office; but if anything, a more important provision of this bill is that which gives the bill its title, namely, the revising and classification of letters patent. For the past ten years efforts have been made to get some such bill through Congress, but hitherto without success. The

Commissioner of Patents is authorized by this bill to undertake the revision and perfecting of the classification for the purpose of determining with more readiness and accuracy the novelty of inventions for which applications for letters patent are or may be filed in the Patent Office, and to prevent the issuance of letters patent for inventions which are not new. Any system or method of classification such as the above should prove of great value as it would undoubtedly save thousands of dollars each year which are now spent in protracted litigation between rival manufacturing concerns over infringements. With some such handy system of classification, the chances of one claim covering another should unquestionably be reduced to a minimum.

The necessity of some form of legislation looking toward an increase of the clerical force in the Patent Office was obvious to every inventor who has recently applied for a patent. During the last decade the business of the Patent Office has increased 33 per cent., whereas the force for conducting the business has increased but 6 per cent. The principal objections brought up against the passage of the bill were based on the fact that it would entail an extra expense of over \$300,000. Assuming that the necessary changes would entail the expenditure of this sum of money, the fees paid by inventors, although not exorbitantly high, more than cover the expenses and certainly entitle them to reasonably speedy service. At present in the case of many novelties the season for them passes before the inventor can secure a patent.

Under the Searchlight.

Notes and Comments on Various Topics.

OF all the electrical papers in New York city, *ELECTRICITY*, containing a full programme of the Twenty-first Convention of the National Electric Light Association, was the only journal to be distributed on the Convention train which left for Chicago on Sunday, June 5.

* * *

Is This Another General Electric Scheme?

The Philadelphia Times of the 9th inst. publishes the following in its financial columns:

The General Electric Automobile Company, stock of which was brought out yesterday on the Philadelphia Stock Exchange, has bought from the well-known electrician and inventor, Rudolph M. Hunter, M. E., E. E., of this city, and others the fundamental patents for electric traction for railways, electric cabs and carriage automobiles, electric car lighting, electric launches, etc., when using secondary batteries or accumulators wholly or in conjunction with dynamos on cars, or when supplied from a distant source through line conductors. Mr. Hunter and associates are said to have expended a very large sum of money in perfecting these patents, of which there are seventy, different and distinct. Competent counsel has passed on the soundness of the legal aspects. They are declared to cover generally and specifically every practical or feasible method of operating cars, carriages, cabs and boats by accumulators, and, as an example of the work already accomplished, it may be said that the modern electric car truck, lighting system and series multiple controller (used upon every electric railway car in the country) are the inventions of Mr. Hunter and covered by the patents controlled by the General Electric Automobile Company.

In another part of the same paper the following appears:

A new candidate for favor was brought out during the day, the stock of the General Electric Automobile Company. Starting at 11½ bid, the price, reflecting good commission house demand, advanced to 12½. Higher prices are thought likely for this stock in the near future. The company was organized under the laws of West Virginia, with an authorized capitalization of \$2,500,000, divided into 50,000 full-paid, non-assessable common shares of the par value of \$50 each. There is no preferred stock, nor any bonds.

Of the total common stock authorized there have been issued 35,000 shares, 20,000 of which are held intact by the controlling interests, leaving 15,000 shares taken over by a syndicate. As an asset for future use there remain in the

treasury 15,000 shares. It is also understood that the treasury will have at the beginning of business a large cash balance. Head officers of the company are located on the fourth floor of the Bourse. The board of directors include J. A. Brill, of the J. G. Brill Car Company, Philadelphia; W. D. Marks, late president of the Edison Company, Philadelphia; Rudolph M. Hunter, inventor and capitalist, Philadelphia; John H. Noblit, capitalist and director of the Frankford & Southwark Passenger Railway Company, Philadelphia, etc. The registrar is the Fidelity Title Insurance & Trust Company of this city.

* * *

AN inventor at Norwich, Conn., is said to be the originator of a new electrical device which promises wonderful results. The invention consists in a method for obtaining or generating electricity without the use of any chemicals or dynamo. The model, for such it is at present, is made of brass and copper. When once placed in position, it is guaranteed by the inventor to last for years, requiring no expense for repairs. It is not connected with or attached to any engine or machine, but is self-operating. A gentleman who witnessed it in operation states that from what he saw the machine can apparently furnish an unlimited amount of electricity at almost no cost. Is this another Keely motor?

* * *

AT the National Electric Light Convention in Chicago there were but few exhibits. The Interior Conduit Company and the Paragon Company had a number of fans in use in various places throughout the Auditorium Hotel and Mr. Randolph had an exhibit in the Annex. From this it will be seen that the number of exhibits was unusually small, there also being a scarcity of souvenirs as compared to previous Conventions. The Circular Loom people presented a briarwood pipe with amber stem, a package of tobacco and a box of matches, and the Okonite Company presented the ladies in attendance with an ornamented table plaque.

Many of the old-timers were present, among whom we might mention Mr. Edward H. Johnson of the Sprague Electric Company, George A. Redmond of the Rochester Gas & Electric Company, Mr. Higgins of Wisconsin, Mr. Randolph, formerly of the Excelsior Company but now of the Sterling Arc Lamp Company, George Fairclough, Col. Hill and Mr. Jampolis of the Chicago Edison Company. A reference to our list of names of those in attendance will show that although the present era seems to be one of great changes in the electrical industry there are still many of the old-timers who always attend these Conventions.

* * *

THE managers of the Electrical Exposition in Philadelphia have made arrangements with a number of experts in the various lines of electrical development to make short addresses on electrical subjects for the edification of visitors to the Exposition. These free lectures will be given every hour from 10 A. M. to 3 P. M., and will doubtless prove of much benefit to those who are able to withdraw their attention from the other attractions of the show.

* * *

IN a recent issue of one of our contemporaries we see it stated among the advertisements that "Even Spain, counting the pennies of poverty, buys Westinghouse electric apparatus." Is it possible that this is one of the reasons why Spain has to count "the pennies of poverty?" Possibly, now that war is being waged, the Westinghouse Company is doing all it can to aid the United States in ruining Spain.

* * *

An automatic electric car fender has been invented by Mr. G. W. Rochester of Ottawa, and the inventor claims that the device is the best yet made. It consists of several pieces of wire netting, arranged on cross bars in such a manner in the front of electric cars that the moment any object strikes this netting another net shoots out in front of the car directly along the ground and picks up the object encountered. There is no possibility of anything getting between this fender and the roadway.

THE CHICAGO CONVENTION.

The National Electric Light Association Meeting a Great Success.

LARGE ATTENDANCE OF CENTRAL STATION MEN.

Report of the Proceedings—The President's Address—Papers and Discussions—The Committee Report on Standard Candle-Power of Incandescent Lamps—The New Officers—List of Attendants.

The delegates to the Twenty-first Convention of the National Electric Light Association commenced to arrive at Chicago on the 6th inst. in formidable numbers, and by evening the corridors and club rooms of the Auditorium Hotel were well filled. In the evening at 8:30 a reception was held. The beautiful parlors of the hotel were profusely and handsomely decorated, the gorgeous palms and the cheerful music making the scene one long to be remembered. Many of the gentlemen were in full evening dress. The toilets of the ladies reminded one of a grand ball. There was no special programme, but every one was left free to mingle with the throng, renewing old-time acquaintances and making new ones. President Insull was everywhere, doing his utmost to show the visitors what a real Simon-pure article "Chicago hospitality" is. He was ably assisted by other members of the Reception Committee. This committee as a whole consisted of C. H. Wilmerding, chairman; B. E. Sunny, J. B. Wallace, Samuel Insull, A. S. Hibbard, E. K. Comstock, F. B. Badt, J. Holt Gates, F. H. Clark, F. S. Gorton, W. H. McKinlock, J. B. O'Hara, Geo. C. Bailey, M. Coster, L. A. Ferguson, G. A. McKinlock, W. A. Kreidler, Chas. Munson, E. B. Kittle, F. W. Kohler, Martin J. Insull, J. R. Wiley, F. E. Donohoe, W. W. Low, R. B. Rawles.

A superb and dainty collation was served and the reception was voted a great success in every way.

On the morning of the 7th large numbers of delegates arrived from the West and Southwest, and by the time the Convention was called to order by President Insull in the Banquet Hall of the hotel the room was crowded. This Banquet Hall of the Auditorium is without doubt the finest and best-appointed room in which the National Electric Light Association ever held a meeting, and its selection was but one of many evidences of liberality on the part of the Chicago fraternity in catering to the comfort of their guests.

When President Insull, at about 11 o'clock, had succeeded in getting the members to take seats by specially calling the attention of Mr. Edgar and some jovial companions to the fact that they were not yet seated, he commenced the delivery of his opening address, which will long be remembered as one of the most instructive, sensible and business-like addresses ever delivered before the Association. The address is here given in full:

PRESIDENT INSULL'S ADDRESS.

Members of the National Electric Light Association—Ladies and Gentlemen: In calling to order the annual convention of your Association my dual capacity presents somewhat of an embarrassment to me. I am in doubt whether as president to enlarge upon the great growth of this Association since its formation in this city on February 25, 1885, or whether as a resident here to dwell at length upon the marvelous growth of the city in which we meet. Chicago and the industry with which we are identified have a somewhat close connection. The growth of the former, if measured from the point of view of the rapidity with which history is made, is, so to

speak, the product of yesterday. The electrical industry, or rather that portion of it with which we are associated, is but little more than the product of to-day. If the growth of this city and that of our own industry is as great during the next thirteen years as the progress they have achieved since the date of your first meeting here, I am sure that both the citizens of Chicago and the members of your Association will have every reason to congratulate themselves. Speaking for those of my friends connected with the electrical industry in Chicago, and also for myself, I can assure you it affords us very great pleasure to welcome you at this convention, and the fact of your meeting in this, my home city, enhances not a little my high appreciation of the privilege of presiding on this occasion.

The officers of your Association have had in mind in preparing a programme for this convention the importance of bringing before you subjects of interest in connection with central station management, and the papers to be read at our various sessions and the topics mentioned for discussion cover such a wide range that it would seem undesirable for me to occupy much of your time by way of introduction. The various gentlemen who have so kindly consented to read papers will deal with such important questions as the cost of generating and distributing the product which we manufacture, transformer economy and the rival claims of alternating currents and direct currents as means of distribution. The many problems which you have to solve in connection with the question of public lighting and the cost of producing electrical energy by water power will also be discussed.

STANDARD VS. SPECIAL MACHINERY.

A matter which has called forth during the last year considerable discussion is the question of the use of standard apparatus and the tendency towards the specification of special machinery on the part of electrical engineers. This course is not by any means confined to large work, but is followed by some engineers whether they are designing a small isolated plant or are projecting a large modern central station. It would seem to me to be of paramount importance to the manufacturer and user that both should co-operate in eliminating as far as possible from the business the necessity of building and using special types of machinery. This can only be done by the adoption of standard specifications for various standard types of apparatus. A committee of the American Institute of Electrical Engineers has already taken this subject under consideration, and I believe that we will be serving alike the interests of the manufacturers and users of electrical apparatus if we will take some action with a view to co-operating with the Institute and other bodies in this matter. In drawing attention to this subject I speak with an appreciation of the position of both manufacturer and user, having had more or less connection with the manufacture of electric apparatus and the manufacture of electric current. Constant duplication of parts resulting in constant duplication of a given piece of machinery means, as any manufacturer will tell you, constant reduction in cost. Variation from a given type means increased cost and even the wiping out of an apparent profit. In the last year or so there has been a great deal of discussion in England prompted by the success of American manufacturers in obtaining large contracts for electric traction work in Great Britain, and the inquiry has often been made, how is it possible for American electrical manufacturers, with high wages against them, to compete with English builders, whose scale of pay to their workmen is on a very much lower basis. If you will examine into the

amount of electric traction machinery manufactured in this country under a system of constant duplication and the use of special tools, and then visit the electrical establishments on the other side of the water and note the tendency there towards specializing each particular job, you will soon recognize that the reason for low cost and consequently low selling price on this side of the ocean is brought about by the fact that in America this class of work is largely designed by the manufacturer, and as a natural result is the duplicate of something already produced, whilst on the other side of the Atlantic the builder of the machinery works from the plans of the electrical engineer, which necessitates his producing something different to fill each different contract. In one case the machinery is really manufactured; in the other case the builder runs a jobbing shop. Unfortunately during the last few years American users of electrical apparatus have somewhat departed from the pursuance of what is really a fundamental principle of American manufacture, namely, the use of existing types which are turned out in large quantities with special tools with a view to the lowest possible cost of production. The electrical engineer for the purchaser has been permitted to draw up specifications which have tended towards the specializing of apparatus, necessarily interfering with rapid manufacture and low cost of the product. The disadvantage to the manufacturer is apparent. It is turning our large electrical works from manufacturing establishments into jobbing shops, cutting down their capacity, increasing their labor cost and lengthening the time that it takes to produce a given article. Looking at it, therefore, from the point of view of the manufacturer, the capacity of his plant is reduced and consequently his interest and general expense cost is higher; his labor cost is increased; and if he finds himself unable to increase his selling price, his shop must be run at a loss instead of at a profit.

The user is necessarily interested in low cost of production on the part of the manufacturer, as he cannot expect to purchase apparatus except at prices which yield a return to the maker. From this point of view alone it would seem to me to be the interest of the user that he should co-operate with the manufacturer with a view to standardizing apparatus eliminating unnecessary variations from a given type and providing specifications for machinery calling for a given capacity at a given efficiency. Such a course would lead to low cost of manufacture and consequently low selling price, coupled with rapid production.

Another objection to special apparatus is the expense and delay in obtaining duplicate parts in case of break-down. The fear of delay under such circumstances often necessitates the user carrying the duplication of his plant to a point entirely unnecessary when standard apparatus is used. Capital investment and consequently interest cost is thus increased, not only by the purchase of apparatus which of itself is expensive to build, but also by the duplication of investment which I have pointed out must of necessity follow.

A further point which should be borne in mind in connection with the lack of standard specifications is the opportunity that it gives to the unprincipled manufacturer to dispose of his second-rate apparatus to the uninitiated. We talk of a machine having a given capacity; but under what conditions should it operate to develop this capacity, and how often does it occur that a dynamo machine is rated entirely too high and at the cost of its efficiency? How much miscellaneous material used in connection with the industry is absolutely unfitted for the purposes for which it is sold? Surely all of us, manufacturers and users, are deeply interested in maintaining the highest possible standard of work and eliminating alike from our central station systems and the installations for our customers worthless appliances whose only recommendation is their apparent cheapness, whereas, as a matter of fact, they are really the most expensive that can be bought, because they are unfitted for the purposes for which they are intended. A proper consideration of this subject would not embrace alone the apparatus we are ourselves in the habit of buying for use in connection with our plants, but also the appliances used in connection with customers' house wiring. It should be borne in mind that faulty apparatus from one cause or another resulting in a stoppage of the service of one or more customers is, in the mind of the user of current, set down to the unreliability of the system as a whole. A central station customer seldom discriminates between a contractor who supplies a worthless device and a company supplying him with current. Standard specifications should therefore cover not alone the machinery used, but also the devices and material forming part of a customers' installation. This Association has addressed itself at various times to the consideration of questions in

connection with house wiring, and has co-operated with the National Board of Fire Underwriters and other bodies with a view to establishing rules to be followed by contractors. I strongly recommend that this matter be taken up on a broader basis than heretofore, and that in conjunction with the technical societies we invite the co-operation of the electrical manufacturers with a view to standardizing apparatus and the specifications therefor, whether for use in the central station itself or in connection with the distributing system.

I do not wish my remarks on this subject to be taken as in any way censuring the many electrical engineers who have by their special training and natural ability done so much to develop the industry with which we are connected. From my experience I am satisfied, however, that from the point of view of the user, the designing engineer who adapts his requirements to the standard apparatus of a first-class manufacture, is able to produce a plant of more satisfactory character and more economical to operate than that designed by those engineers who I regret to say are sometimes influenced by the desire to use machinery which they can claim as their own handiwork rather than use something that would be quite as satisfactory and has the advantage of being the regular product of an established manufacturer.

The consideration of the subject of standard specifications would naturally include the preparation of specifications with relation to the manufacture of incandescent lamps. For several years past a committee of this Association has had this subject under consideration. It has been found practicable by a number of large central station companies connected with another association and buying from one manufacturer to purchase their lamps under specifications which provide for the testing of samples of the product of the factory, the payment for lamps supplied being based on the results of the tests. It seems to me that it would be possible to adopt standard specifications under which our members could purchase their lamps from any reputable lamp manufacturer. The importance of this matter will be appreciated when it is remembered that the cost of lamp renewals per unit of output exceeds \$1.00 per ton of the cost of fuel in operating a central station with the most modern steam plant.

SELLING PRICE BASED ON COST.

It is of prime importance to central station managers that they should sell the product they manufacture, namely, electric current, to the greatest number of consumers at the lowest possible price, and yet obtain a reasonable profit. For a number of years the basis of charge on the part of most companies has been a given unit price, with discounts for quantity. In the early days of the business some companies were in the habit of charging a fixed price per lamp per month, having no control whatever over the use of the product, but being necessarily responsible for the increased operating expenses caused by the wastefulness of customers who could hardly be expected to economize, inasmuch as they paid exactly the same price for the use of light whether they burned it one or twenty-four hours a day. A majority of these companies, however, following this last method, realized at an early date the absurdity of distributing that for which they were not paid, and as a result I presume we can fairly assume that electric lighting business (with the exception of arc light service) is run almost universally on a meter basis. It is therefore unnecessary for us to discuss the question as to whether the measuring of current is a desirable thing in our business, as it is now generally recognized as a necessity. If you will make a careful examination of the factors entering into the cost of current, you will very quickly come to a realization of the fact that interest is by far the most important single element, and that this item varies very considerably with the different classes of service furnished by a central station company. The interest factor in cost depends upon the yearly average consumption of your product by the customer; or, to put it another way, you can figure your interest on the basis of so much per unit of output at maximum load. For instance, take the two probably extreme classes of customers to whom the central station company supplies current for lighting purposes. On the one hand you have an office building whose tenants only use artificial illumination for a very short space of time each day during the winter only. On the other hand you have a basement customer whose use of your product averages nearly one half of the day of twenty-four hours during the whole year. Your investment, to take care of each of these customers, is practically the same; therefore, your total interest cost must be the same in both cases, but if you distribute this interest cost over the actual units consumed you will find that the tenant of the office building

costs you for interest per unit of current sold many times more than does the occupant of the basement. There are of necessity as many different grades of customers between the two extremes I have mentioned as there are different classes of business and different characters of structures in which these businesses are conducted. Surely, if the cost of production varies according to the different conditions under which your customers use your product, it is but fair that the selling price per unit should vary correspondingly. If it does not, you, of necessity, encourage the use of electricity by customers whose business is unprofitable to you, and discourage the use of your product by customers whose business at a lower price would yield you a fair return. In past conventions the question of how to improve the load for the purpose of raising the average output, what classes of business should be encouraged other than lighting to achieve this result, and the price at which we can afford to sell current to the operators of these different lines of business, have come up for discussion. At the last convention the realization of the fact that great differences exist in the elements governing the cost of product for different classes of lighting customers was ably presented by Mr. Arthur Wright, and he pointed out that the improvement of your load factor, the broadening of your curve and the rendering less acute of your peak is a matter within your own adjustment, providing that you will realize in considering cost with a view to making a selling price that conditions are so dissimilar that the expense to you per unit of supplying two customers in the same block is likely to be widely different. Various plans have been adopted by a comparatively small number of companies to meet the conditions as we now know them to exist. Some companies have adopted the scheme of allowing certain special discounts providing the income per month per lamp connected exceeds a certain amount. Other companies charge one rate for current used during certain specified hours of the day and a much lower rate for the current used during the remaining hours of the day. A third method is a system of discounts based upon the total consumption of current during a given period, considered in connection with the maximum consumption at any time during that same period.

These various methods all have the same object in view, namely, the meeting of the conditions of each individual customer, and yet at the same time earning a fair return on all of the investment provided for all of your customers.

In discussing this matter I have referred alone to interest cost because it forms so large a proportion of the total cost, but you will find that this same principle enters into a number of the other elements which go to make up your total cost. It would therefore appear to me that in considering the cost of generating electricity you should bear in mind that a large proportion of the items which go to make up the total are within your own control, and their amount per unit of output depends very largely upon the methods adopted in selling your product.

PUBLIC CONTROL AND PRIVATE OPERATION.

A subject of growing importance to a number of our members is the question of the public ownership and operation of the undertakings now operated by electric lighting companies. The agitation in connection with this subject has called forth a great deal of discussion, partly by those interested in it simply with a view to extending the influence of political parties, and partly by serious disinterested thinkers who believe that the best interests of the greatest number are to be obtained by the creation of a municipal socialism, which, if carried to its logical conclusion, must ultimately result in municipalities performing, with others, such public service work as we are engaged in, and also in producing the food we eat and the clothes we wear. To those occupied in the management of electric lighting properties it does not seem possible that the movement in favor of municipal operation of electric lighting plants, based upon the assumption that a municipality can produce electricity cheaper than, or even as cheap, as a private corporation, is well founded. We all realize, from the close attention we have to give to our own affairs, that self-interest and the necessity of getting a return on our investment are the first essentials to the economical administration of large enterprises. While I do not pretend to claim that electric lighting companies are beyond reproach, I wish to point out that many of the evils complained of as pertaining to corporate management are the direct results of the enforcement of unwise conditions through legislative action. Ill-advised efforts are often made by legislative bodies to secure advantages in the direction of control which cannot be obtained without giving an equivalent in protection to the industry. This causes the

investor to feel that his property is being attacked and compels him to resist such legislation. The result is a feverish agitation, crimination and re-crimination, between the would-be improvers of municipal government and the owners of corporate properties without reaching a conclusion satisfactory to either. The fallacy of the so-called reformer's theory results from looking only at what he calls the injurious effects of corporate management without taking into account its indisputable benefits. He does not seek for the cause of the trouble. If reformers will take accurate account of all the points in the problem they will discover that the evils complained of result from errors in legislation designed to determine the relations between municipal bodies and electric lighting companies. It seems to me that the claim that municipal operation is the universal cure for all diseases for which electric lighting companies are supposed to be responsible, merely proposes the substitution of political in the place of industrial management. This raises the question: Is the administration of municipal affairs in the various cities throughout this country so economical as compared with the management of private industries and the class of service rendered so efficient as to justify the increasing of the burdens already imposed upon municipal government? It appears to me that a correct division of power and responsibility requires political government to control private industrial management. Where political government and industrial management are merged into one interest, the power of control is seriously impaired, since a political administration cannot be reformed without overturning the party in power.

I cannot bring myself to the belief that the citizens of this great country are in fact opposed to large aggregations of capital in corporate form, as such aggregations are absolutely necessary to the operation of all great undertakings by private enterprise. It is as impossible to operate such vast affairs with individual capital, as a personally owned business, as it is for us to live without municipal, state and national governments. The misunderstandings which from time to time occur between communities and the managers of electric lighting companies will, to my mind, disappear entirely if the relations between the two are correctly founded on the basis of public control, with corresponding protection to the corporations operating this industry. It would seem to me to be a very proper function for this Association to address itself to educating the public to a definite legislative policy which will be fair to the municipalities, securing to the public the best service at the lowest possible price, and protect corporations by giving them franchises which, while conserving municipal control, will insure to the investor the permanency of the undertaking.

COMPETITION IS NOT THE TRUE REGULATIVE FORCE.

It is supposed by many who discuss municipal affairs that the granting of competitive franchises for public service work is the true means of obtaining for users the lowest possible price for the service rendered, whereas, as a matter of fact, the exact opposite is the ultimate result. This is proved by results in all large cities where the most severe competition has taken place. Acute competition necessarily frightens the investor, and compels corporations to pay a very high price for capital. The competing companies invariably come together, and the interest cost on their product (which is by far the most important part of their cost) is rendered abnormally high, partly owing to duplication of investment and partly to the high price paid for money borrowed during the period of competition. The selling price of a service should be based on its cost, and in any business such as public work, where the investment is large and the annual turn-over is comparatively small, if the item of interest be unnecessarily augmented, it must be reflected in the price paid by public and private users.

While it is not supposed to be popular to speak of exclusive franchises, it should be recognized that the best service at the lowest possible price can only be obtained, certainly in connection with the industry with which we are identified, by exclusive control of a given territory being placed in the hands of one undertaking. In most European countries public service corporations enjoy exclusive franchises under proper control, and are able to obtain capital for their undertakings at the lowest commercial rates, thus materially affecting the cost of their product, of which interest, as I have already stated, is necessarily so great a part. In order to protect the public, exclusive franchises should be coupled with the condition of public control requiring all charges for services fixed by public bodies to be based on cost, plus a reasonable profit. It will be found that this cost will be reduced in direct proportion to the protection afforded the industry. The more certain this protection is made the lower the rate of interest

and the lower the total cost of operation will be, and consequently the lower the price of the service to public and private users. If the conditions of our particular branch of public service are studied in places where there is a definite control, whether by commission or otherwise, it will be found that the industry is in an extremely healthy condition, and that users and taxpayers are correspondingly well served.

COMPENSATION FOR FRANCHISES.

When prices for service are based on cost it matters not whether in the establishment of a system of legislative control provision is made for paying a portion of the receipts direct to the municipality. If the public demands a percentage, surely we can afford to pay it, as it would simply be added as an item of expense on which our selling price would be figured. If the public does not demand a percentage, this selling price would be proportionately less. It is simply a question as to whether our municipal bodies prefer to raise a portion of their income by taxing their citizens through the agency of public service corporations, or whether they prefer to raise that portion of their income by collecting it direct from citizens themselves. Revenue raised by a percentage on gross receipts of the electric lighting business would, at the present time, however, seem to be somewhat unfairly obtained in cases where the selling price is subject to legislative control and based on cost of service, as the result would be that a small minority of citizens using electricity would be forced to contribute largely to the public revenue, whereas the benefits enjoyed therefrom would be to the advantage of the whole community.

TAKING PRIVATE PROPERTY FOR PUBLIC USE.

Another point that should be included in a proper scheme of public control is a condition under which the municipality would have the right to purchase the undertaking. Such a right should include a direct obligation on the part of the municipality to purchase the property at a fair price whenever it is thought desirable that the industry should be operated by the municipality. The possibility of the exercise of the right of purchase by the municipality would of itself make it to the interest of the owners of the property to do their full duty in their relation to the public. On the other hand, if a community licenses a corporation to perform a certain public service, and if that corporation invests its money and develops its business, surely it is unfair for that community to go into the same line of public service work itself without first purchasing the existing plant. If this is not done the value of private property will be destroyed without just compensation being made therefor in an attempt to secure a public benefit. I do not believe that the people as a whole are so unfair as to demand that such a course shall be taken.

My recommendations on the subject, which I have just presented, are by no means original. Most public service corporations in Great Britain are run on practically the bases indicated, and in more than one State in the Union corporate legislation has taken the same direction.

I would summarize the position which I think we should take on this subject in just two sentences.

First—Franchises granted to public service corporations should secure them the same degree of protection in their rights to their property as is enjoyed by other investments.

Second—Public control of charge for service based on cost plus a reasonable profit, and eliminating the factor of competition, is the proper safeguard for the interests of users, taxpayers and investors.

The address was followed by hearty applause.

President Insull requested that the subjects presented in his address, being of vital interest, be discussed some time during the meeting. He then read numerous letters of regret from absentees, among them being those of A. M. Young of Waterbury, Conn., Nikola Tesla and Elihu Thomson.

A number of invitations were read from various Chicago concerns tendering hospitality to the Association. These were referred to the proper committees for action.

The President then announced the next order of business to be the paper by Mr. Calvin W. Rice, Brooklyn, N. Y., "Cost of the Generation and Distribution of a Unit of Electricity."

Mr. Rice said he was fully aware of the responsibility of undertaking a discussion of the subject he had chosen and would confine his remarks to a resumé of the most reliable data at hand. In America the variation in the investment per kilowatt is \$200 to \$750 according to the capacity of the

installation; in the great majority of cases the cost was \$400. The majority of plants in Great Britain and the Continent cost \$500 per kilowatt installed. The importance of keeping down the investment per kilowatt, he said, need not be emphasized, and the location of the plant ought to be considered with reference to all influences, having in view the dollars and cents value per year for each consideration. In buying steam and electric plants it was essential to consider reliability above everything. It is of assistance in examining bids on electrical apparatus or engines to compare the prices per pound and weight in pounds per kilowatt or horsepower, and in considering boilers, heating surface and pounds per horse power as well as price per pound. He introduced tables showing that the cost of fuel averages 46 per cent. higher where the dynamos are rope-driven than where the dynamos are direct-driven by high-speed engines. Good regulation in the station, he said, was more important than high efficiency, and the value of accessories in the reliability of a plant and the reduction of labor and attendance are important. He enumerated these accessories under the headings of feed-water appliances, boiler appliances, cranes and auxiliary apparatus. Tables were introduced to show that electricity as delivered at the switchboard is generated with economy and can be used more advantageously than steam. The use of an oil-distributing system reduces the amount of oil consumed and the attendance required. He recommended the use of the air-blast for cleaning around generators. Referring to the distributing system, he said the cost of underground construction is about four times that of overhead construction, and great care should be taken in the choice of duct and insulation on conductors. In testing cables the testing apparatus should be at least about 50 kilowatt capacity, and the test pressure should be maintained at least one hour. Mr. Crompton's system of estimating the cost and profit per unit of 1,000 watts maintained for one hour was given, from which it was deduced that it required 50 cents worth of plant to generate and distribute one kilowatt hour per year. Load factor was considered, and the advantages of a high-load factor pointed out and illustrated by a table from an English source. The cost per unit of a number of English stations, and the average cost of coal and contract price per arc lamp per year in American cities were given. These averages, obtained from the statistics of 46 States concerning arc lighting, were also given: Hours per year, 3,326; coal, per ton, \$3.03; contract per year, \$101; price per hour, \$0.34. Treating of railway plants, Mr. Rice's paper gave a great deal of tabular information which we defer to a future issue.

When Mr. Rice had finished the reading of his paper, the President announced that discussion of the paper was in order, remarking that the topic following for discussion, "Prices and Discounts for Electric Current and Methods of Billing Current to Customers," was so closely interwoven with the subject of Mr. Rice's paper that they might both be discussed together.

The discussion which followed was participated in by Messrs. Scovil, Rice, Ayer, Barker, Coggeshall, Wagner, Dow, Creeden, Insull, Armstrong, Van Trump, Hubeley, Wendell, Ferguson and Weeks, and, as the latter remarked, there had been few discussions before the Association of greater importance to central station interests. At its conclusion the Convention adjourned until 3 o'clock.

AFTERNOON SESSION.

President Insull called the meeting to order at 3:10 P. M., and announced the first paper to be that of Mr. Alexander Dow of Detroit, Mich., on "Public Lighting With Relation to Public Ownership or Control."

Mr. Dow's paper was followed by papers on the same subject by Mr. Samuel Scovil of Cleveland, Ohio, Mr.

H. M. Atkinson of Atlanta, Ga., and Mr. E. H. Davis of Williamsport, Penn.

At the conclusion of the reading of these papers the meeting adjourned to executive session.

WEDNESDAY, JUNE 8—MORNING SESSION.

President Insull called the meeting to order at 10:30 and announced that the papers for the morning session would be that on "General Distribution from Central Stations by Alternating Currents," by Herbert A. Wagner of St. Louis, and "General Distribution from Central Stations by Direct Currents," by Louis A. Ferguson of Chicago.

The purpose of Mr. Wagner's paper was to show the alternating current applied in the same manner as the direct current with a view to comparing the results. The various methods of distribution are then reviewed. He advocated a combination of the alternating and direct current systems by adopting the most desirable features of each. Such a combined system is described in detail as being in successful operation. The paper ends as follows: "In summing up, we find the following marked features in which the alternating current, properly installed, has been shown to have pronounced superiority over the direct current: Highest possible efficiency of distribution and operation; best regulation; largest territory desired readily supplied from one station; comparatively small cost of feeders, effecting enormous saving in investment; least cost of real estate; cost of installing and operating sub-stations entirely avoided; the only system in which all classes of service can be supplied from one type of generator; greatest flexibility." Diagrams of distribution efficiency curves and distributing systems were given.

Mr. Ferguson at the outset stated in his paper that he does not blindly advocate the general use of direct currents under all conditions for both transmission and distribution of electricity for commercial purposes. Reference is made to and description given of the method of distribution by the Chicago Edison Company as representing the latest development in direct-current distribution. Variations in load were shown by means of ampere curves for each station. In the Chicago Edison system three-phase alternating current is used for long distance transmission with step-up and step-down transformers. The alternating current is conceded to play an important part in the distribution of electricity by this company. In some central stations two or more pressures are used. This is not economical except when the dynamos can be worked very near the maximum load. The method most to be recommended is to have the dynamos and storage batteries feed into one general system at different points. The useful field of operation for an alternating current distribution system is to be, in the opinion of Mr. Ferguson, suburban residence districts and not large cities. Various diagrams and pressure charts were shown in connection with the paper.

After the reading of these papers, President Insull said: I have pleasure in calling upon Prof. Fujioka, one of our honorary members, who is professor of electrical engineering at the Imperial University of Tokyo, Japan.

Prof. Fujioka—Mr. President and Gentlemen: In opening this discussion I wish to give some description of what we have done in Japan. Although I have the honor to be an honorary member of your Association, I have very little opportunity to attend your Conventions. I shall take great pleasure this morning in giving a short description of the plant and system which has been carried out under my direct supervision in Japan. I have no data to be compared with the papers which have been read, so I will draw a rough map of Tokyo. We originally had five central stations. No. 1 station was originally installed in 1883 entirely with the Edison three-wire system. Nos. 2, 3, 4 and 5 were installed afterwards, also on the Edison three-wire system. Before going further I would like to say that these

are some conditions peculiar to Japan; that is to say, the city of Tokyo has quite an extended area, occupying about 100 square miles, and the buildings are scattered, and we have not high buildings because of the danger from earthquakes. I saw the advantages of the Edison three-wire system of distribution, so we began to supply the more crowded parts of the city by means of the three-wire system. We subsequently found that it was necessary to supply current to more settled parts of the town, so we added single-phase alternating currents in most of the other stations. Since we saw the advantages of the three-phase current transmission we have decided to install one big power station near the river. All the former stations were worked with high pressure non-condensing engines, and I may state that coal in Japan, particularly in Tokyo, is very expensive, costing \$5 to \$6 a ton. So we found that it might be wiser to install a condensing station near the river, having triple expansion engines. We installed ten triple expansion engines on the condensing system, each engine coupled to low speed generators, four of them single-phase generators. The three-phase generators were wound for 3,500 volts, whereas the single-phase were wound for 2,000 volts. We did not like to disturb the existing three-wire network in this crowded portion of the city, and we wanted to keep the three-wire network as we have had it for about ten years. The way I have done it was to place induction motors in No. 1 station, taking out all the engines and boilers, and placing the induction motors in the same place as we had the engines. So in the same way Station No. 3 was converted in a similar way, and in Station No. 2 we have four induction motors, each 150 H.P., directly connected to multiphase direct-current dynamos. No. 4 station was taken down altogether. In No. 5 station we took down all the old engines and dynamos, and replaced the three phase transformers with the four-wire systems for alternating currents. The other parts are coupled by means of 2,000 volt single-phase currents, raising the voltage at the necessary place to the required potential. In that way we have succeeded in reducing a great deal of the expense in fuel and labor items. I cannot tell at present the exact proportion of the decrease, but we know we have reduced the expenses materially, and I shall be pleased if this brief description will convey to you some idea of what has been done in Japan. (Applause.)

The President—The general subject of alternating currents and direct currents for electric lighting is now open for discussion.

The discussion on these subjects occupied the remaining hours of the morning session and was continued in the afternoon session, the advocates of both systems going into various details showing their comparative efficiencies or defects.

WEDNESDAY—AFTERNOON SESSION.

The President called the meeting to order at 3:15 P. M.

As mentioned, the discussion of the papers on the general distribution by alternating and direct currents was resumed. The members engaged in the discussion from the beginning were Messrs. Thayer, Wagner, Van Trump, Robinson (of Baltimore), Dow, Wilmerding, Ferguson, Goldsborough, Scovil, Rice, Insull, Ayer, Fakes, Davis, Stetson, De Camp, Hubeley, Chandler, F. E. Smith, Walbank and Carnes.

At the conclusion of Mr. Carnes' argument the President said he would close the discussion by having some remarks from Mr. Wagner and Mr. Ferguson, giving the preference in time to Mr. Wagner who was a visitor to Chicago.

Mr. Ferguson argued in favor of the direct current system of distribution and referred to the various Edison stations throughout the country as sustaining his position. He exhibited a curve which represented the efficiency of distribution of the Edison central stations in Boston, Detroit, the original

Adams street station of the Chicago Edison plant, and others, and which he said at all times showed a higher efficiency than that of the best alternating current station presented in the papers read. But, he said, the real thing is not the curve of efficiency, but the actual cost of the production of the unit of electricity. In regard to regulation, he said: If the alternating companies propose to have a pressure regulation equal to the direct current they must operate in parallel if they hope to have the same regulation.

Mr. Wagner said he did not favor the use of the alternating current in every location and for every application. If a system is to be changed, and a station which has been operated for some years is to shut down, and it has a large number of direct current motors and devices to do the work required of the direct current, involving a large investment, it might not be at all advantageous to change it to an alternating current station; but for reaching out into new districts and developing them it seemed to him that there would be no use for using the direct-current rotary transformer. The Brooklyn Edison Company has a station which has been in operation some time, where they have installed a large plant some six miles from the center of distribution. They are generating alternating current entirely, three-phase, carrying it to their former centers of distribution and transforming it into direct current. The fact that they are doing it, and the Chicago Edison Company is preparing to do the same thing in some instances, shows that there is economy in moving the central station to one side of the district to be lighted, where real-estate is cheaper, where water can be obtained for condensing and coal can be had cheaper; and in order to do that in most cities it is necessary to employ alternating currents, because the distances obviously become too great for the use of the direct current.

When Mr. Wagner concluded his remarks the Convention adjourned until Thursday morning.

On Wednesday evening Mr. Joseph Wetzler delivered a lecture on "Electricity Direct from Coal," illustrated with stereopticon views. The lecture was well attended.

THURSDAY—MORNING SESSION.

President Insull called the meeting to order at 10:40 A. M. The first paper read was on the "Cost of Producing Electric Power by Water Power from Lachine Rapids, Canada," by W. McLea Walbank of Montreal.

Mr. Walbank stated in his paper that as far back as 1866 a company was formed to erect dams and utilize the water power of Lachine Rapids but the scheme never materialized. Another company was organized on a solid financial basis in 1895, and two years later had a plant completed. A description and the cost of this plant were given in detail. Mr. Walbank, in justice to the Lachine Rapids plant, gives first the cost per kilowatt per year for the portion of the plant at present installed and ready for operation, and second what the cost will be per kilowatt per year when the whole water power development is in operation. The first amounts to \$22.97 per kilowatt on a twenty-four hour day basis, the second to \$8.14 on a twenty-four hour run. In concluding, Mr. Walbank stated that he hoped he had shown that where reliable water power can be obtained within reasonable distance from power centers it can be made to produce cheap electric current.

The discussion on Mr. Walbank's paper occupied considerable time and was participated in by Messrs. Wagner, Walbank, Ferguson, Insull, Fakes, Davis, Matlack, Rice and Anderson.

The President at the close of the discussion called upon Prof. Goldsborough to read his paper on "Transformer Economy."

Prof. Goldsborough read his paper. As the title indicates, the paper treats of the economy of the static transformer of alternating currents from

various standpoints. The result of a number of tests made of various designs of transformers at the laboratories of Purdue University were especially referred to. With but one exception the transformers tested surpassed the requirements of the specifications laid down by Prof. Jackson, and conformed fairly closely to the published guarantees of the companies submitting the transformers for test. The matter of burn-outs was touched upon as not always being due to faulty construction, but frequently to poor installation.

The President—Gentlemen you have heard this very interesting paper and it is before you for discussion. I beg, however, at this time to announce the committee to nominate officers and members of the Executive Committee for the ensuing year. I will appoint as a Nominating Committee the following gentlemen: A. M. Robertson, Minneapolis, Minn.; James Dee, Houghton, Mich.; James I. Ayer, Boston, Mass.

The President then announced that the discussion on Prof. Goldsborough's paper would be proceeded with.

The discussion, which was opened by Mr. Layman, drew into it Messrs. Thayer, Werts, Wagner, Davis, Matlack, Walbank and Huntley. At its close the Convention adjourned until 2:30 P. M.

THURSDAY—AFTERNOON SESSION.

President Insull called the meeting to order at 2:55 P. M. The first business was the report of the Committee on "Standard Candle Power of Incandescent Lamps," Dr. Louis Bell, chairman. Mr. Ayer presented the report of the committee, as follows:

Your committee has been able to have tested in the most careful manner, through the courtesy of Prof. W. L. Puffer of Boston, sixteen incandescent lamps from eleven different makers. The lamps were obtained directly from the makers or their authorized agents and were known to be for test.

These lamps were all sold for 16 C.P., 110 volts, no watts specified, and may be fairly assumed to represent the product which would be shipped to consumers who did not desire the lamps for test, although one batch of lamps came with the bases marked to show the point to be turned toward the photometer screen.

On test these lamps, 33 in all, averaged 14.1 mean normal C.P. and about 11.7 mean spherical C.P. Only one batch of three averaged over 16 normal C.P. One batch fell below 11 normal C.P. and two below 12 normal C.P. Five makes fell below 14.5 normal C.P. The highest average of any batch was 16.99, the lowest 10.82. The average consumption of energy was almost exactly 4 watts, the lowest 3.78 watts per candle, and two batches ran over 5 watts. It should be noted that the voltage was determined by a Weston voltmeter freshly compared with Clark cells, and each lamp was marked at its marked voltage (110).

A separate series of tests showed that these lamps on the average gave their mean spherical candle-power when measured under rotation with their axes tilted 44° and 24° from the vertical toward the photometer, thus confirming closely your committee's estimate of 45° as a proper angle.

A series of tests on proper speed of rotation showed that the best results were obtained with a speed of 200 to 250 revolutions per minute, and that the lamps would readily stand this speed.

Many of the lamps showed bad spherical distribution, which seems to be quite needless since it is merely a matter of properly proportioning the form of the filament.

Of an equal number of batches of 32 C.P. lamps only one batch averaged 32 normal C.P., the majority falling to from 26 to 28 C.P. The 32 C.P. lamps averaged slightly greater efficiency, but were otherwise much like the 16 C.P. size.

From this investigation the fact stands out that the incandescent lamp sold for 16 C.P. is on the whole a lamp which is often giving considerably less than its rated C.P. even when new. Some of these lamps would probably show a temporary increase of candle-power after say 50 hours' burning, but the committee has not extended the research in this direction as yet, and adheres to the opinion that the initial candle-power is the only practical commercial test, and any increase consequently is simply to be regarded as a device for keeping the lamp a little longer from its inevitable decay.

From these and other data kindly furnished by

manufacturers and obtained from various other reliable sources, your committee is convinced that the need of a uniform rating is even greater than it concluded it was in the preliminary report of last year, and that a rating test in order to be effective must involve measurement of candle-power of lamps in more than one direction. Neither mean horizontal nor mean spherical candle-power, nor candle-power in any one direction, will define a lamp well enough to ensure adherence to the rating. Your committee therefore recommends that incandescent lamps be required to conform both to a standard mean normal candle-power and to a mean candle-power when revolved with the axis tipped 45°, this representing the spherical distribution. It recommends that the limits for the mean normal candle-power be 15 and 17.5 cp. Unless the minimum be as high as 15 there will certainly be found a tendency to produce lamps near the lower limit. The 45° should be at least 85 per cent. of this minimum. This is not an excessive requirement and will tend to prevent working near the lower limit of horizontal candle-power unless with a lamp very good in other respects.

Your committee has blocked out a standard form of photometer, a type of which it proposes to build, test and put at the disposal of the Association with directions for proper use.

It suggests that testing be by sample, a lot of ten lamps being taken from each barrel. Of these no lamp when run at its marked voltage shall show less than 15 nor more than 17.5 cp. mean horizontal when rotated at 200 to 250 revolutions per minute; and no lamp shall give when thus rotated at 45° inclination less than 85 per cent. of the above minimum.

The committee will make arrangements for standard lamps as indicated in the preliminary reports to go with the standard photometer.

Mr. Barleigh—I move that the report of the committee be adopted, that this committee be discharged and another committee be appointed to continue the work.

Motion carried.

The President appointed as a committee: Chairman, James I. Ayer of Boston, Louis A. Ferguson of Chicago, and Calvin W. Rice of Brooklyn.

The Committee on Amendments to Freight Classification requested further time to report, and the report was postponed until the next meeting.

The Committee on Legislation Concerning Theft of Current made a verbal report in which they stated that the committee had collected laws passed in 27 different States bearing on this subject, and they recommended that the same be published for the benefit of the members of the Association.

The recommendation of the committee was adopted and a new committee was formed as follows: Chairman, E. A. Armstrong of Camden, N. J.; James I. Ayer of Boston, and A. W. Field of Columbus, O.

The meeting then adjourned to executive session.

The report of the Secretary and Treasurer was presented, showing the affairs of the Association to be in a flourishing condition.

On motion of Mr. Armstrong, the following resolution was adopted:

Resolved, That the annual meeting shall be held in May or June in each year alternately in the cities of New York and Chicago, unless otherwise directed by the executive, and on such date as the committee shall determine.

On motion of Mr. Atkinson, a very hearty vote of thanks was passed to President Insull for his untiring efforts for the success of the Chicago Convention.

Mr. Ayer moved that the thanks of the meeting be extended to the Chicago Edison Company, the Metropolitan West Side Elevated Road, the South Side Elevated Road, the Northern Steamship Company, the Chicago Telephone Company, the American Telephone & Telegraph Company, and all others who had extended courtesies to the Convention for their kindness in so doing.

Mr. Field moved a vote of thanks to the Reception Committee for their very considerate attention to the ladies accompanying the delegates to the Convention.

The following officers were elected for the ensuing year:

President—A. M. Young, Waterbury, Conn.

1st Vice-President—E. H. Rollins, Denver, Col.

2d Vice-President—F. A. Gilbert, Boston, Mass.

Members of the Executive Committee—Samuel Insull, Chicago; Samuel Soovil, Cleveland, O.; H. M. Atkinson, Atlanta, Ga.; F. A. Copeland, La Crosse, Wis.

The Convention then adjourned sine die.

ATTENDANTS AT THE CONVENTION.

Abbott, Jno. Jay, Chicago Edison Co, Chicago.
Ayer, Jas. I., American Elec Htg Corp, Boston.
Arnold, W. L., Siemens & Halske Elec Co, Chicago.
Atkinson, H. M., Georgia Elec Light Co, Atlanta.
Abbott, W. L., Chicago Edison Co, Chicago.
Allen, R. D., Siemens & Halske Elec Co, Chicago.
Atkins, O. H., General Electric Co, Chicago.
Atkinson, J. M., J. M. Atkinson & Co, Chicago.
Armstrong, E. A., Camden Lt & Htg Co, Camden, N. J.
Appleton, J., Elec Storage Battery Co, Philadelphia.
Abadie, E. H., Wagner Elec Mfg Co, St. Louis.
Andres, J. Frank, Belleville Gas Lt & P Co, Belleville, Ill.
Anderson, H. S., United Elec Light Co, Springfield, Mass.
Armstrong, F. O., Dick, Kerr & Co, Toronto Canada.
Andrews, W. S., General Electric Co, Schenectady, N. Y.
Barr, Edw. L., W. R. Bixey, Chicago.
Badger, Jr., F. H., Montmorency Elec P Co, Quebec, Can.
Baker, Jr., C. O., Baker & Co, New York.
Baird, M. E., Eddy Elec Mfg Co, Windsor, Conn.
Bement, A., Bement & Co, Chicago.
Brooke, W. M., Elec Appliance Co, New Orleans.
Bayer, F. N., General Elec Co, Chicago.
Babbitt, H. D., Chicago Edison Co, Chicago.
Boettcher, C., Imperial E L Co, St. Louis.
Brinkman, C. S., Imperial E L Co, St. Louis.
Barron, A. M., The Home Elec Lt & P Co, Elkhart, Ind.
Burleigh, J. J., Atlantic Elec Lt & P Co, Camden, N. J.
Bradley, J. M., Birmingham Consol. Elec Co, Birmingham, Ala.
Bean, Jr., W. Worth, St. Jos. & Benton Harbor E R & L Co, St. Joseph, Mich.
Bowen, G. S., Elgin, Ill.
Benton, C. A., New York.
Butler, W. W., Milton Elec Lt & P Co, Milton, Pa.
Brooke, F. A., Charleston T-H Elec Co, Charleston.
Baird, F. B., Chicago.
Burke, F. E., Mass. Gas & Electric Commission, Boston.
Blum, A. J., American Carbon Co, Fremont, O.
Carnes, S. T., Memphis Lt & P Co, Memphis, Tenn.
Clark, Frank H., Elec Storage Battery Co, Chicago.
Comstock, L. K., Western Elec Co, Chicago.
Clisdel, Percy A., General Electric Co, Minneapolis, Minn.
Cutter, Henry B., Cutter Elec & Mfg Co, Philadelphia.
Cutter, H. B., Mrs., Philadelphia.
Coster, Maurice, Westinghouse Elec & Mfg Co, Chicago.
Carr, R. F., Dearborn Drug & Chemical Works, Chicago.
Crossman, T. E., New York, official stenographer.
Crowell, H. H., General Electric Co, Syracuse, N. Y.
Culver, J. H., Culver Electric Co, Decatur, Ill.
Connor, J. F., Chicago.
Carlton, W. G., Chicago Edison Co, Chicago.
Child, Chas. T., American Electrician, New York.
Cooke, J. H., Buckeye Electric Co, Chicago.
Cheney, H., Chicago Edison Co, Chicago.
Crider, J. S., Washington Carbon Co, Pittsburg, Pa.
Credely, T. H., Chicago Edison Co, Chicago.
Coggehall, H. F., Fitchburg Gas & Elec Lt Co, Fitchburg, Mass.
Cillo, H. J., Edison Elec Lt & P Co, St. Paul, Minn.
Crawford, Ron Id., Stamford Gas & Ee Co, Stamford, Ct.
Crouse, J. B., Crouse-Tremaine Carbon Co, Fostoria, O.
Clark, E. W., Evanston, Ill.
Cumings, Jas. F., Armortite Int Conduit Co, Pittsburg.
Cutter, Geo., Chicago.
Comstock, C. G., Smith Hill Elevator Co, Quincy, Ill.
Cravath, J. R., Chicago.
Copeland, F. A., Edison Lt & P Co, La Crosse, Wis.
Candee, Willard L., Okonite Co, New York.
Conover, Geo. W., Chicago.
Cutter, Harry H., Cutter-Hammer Co, Chicago.
Channon, H. O., Quincy, Ill.
Cooper, Thos., J. Kin Elec Lt & P Co, Pekin, Ill.
Cunningham, J. W., Capital Elec Lt, Motor & Gas Co, Boise, Idaho.
Cate, Geo. W., Edison Illuminating Co, Detroit, Mich.
De Land, Fred, Electrical Engineers, Chicago.
Dibble, S. F., General Electric Co, Chicago.
De Camp, A. J., Brush Electric Co, Philadelphia.
Downs, B. H., Electric Appliance Co, Minneapolis.
Doan, J. P., Jacksonville Gas Lt & Coke Co, Jacksonville, Ill.
Dow, Alex., Mutual Electric Light Co, Detroit.
Davis, Ernest H., Lyeonung Electric Co, Williamsport, Pa.
Dull, P., Milledgeville, Ill.
Daniels, A. L., H B Camp Co, North East, Pa.
Downes, L. W., D & W Fuse Co, Providence, R. I.
Doo, A. V., Philadelphia.
Dee, Jas. R., Peninsula Elec Lt & Power Co, Houghton, Mich.
Drake, O. F., Fort Scott Elec Lt & Pow Co, Fort Scott, Kan.
Dysternd, E., City Elec Lt Plant, Monterey, Mexico.
Dale, Jno. H., The Dale Co, New York.
Egar, H. T., Jandus Electric Co, Boston.
Eddy, Chas. M., Dearborn Drug & Chemical Works, Chicago.
Ely, J. H., Georgia Elec Light Co, Atlanta.
Engel, W. T., Charlotte Elec Co, Charlotte, N. C.
Ebert, J. W., Western Electric Co, Chicago.
Foster, Geo. B., Walker Co, Chicago.
Ferguson, Louis A., Chicago Edison Co, Chicago.
Ferguson, James, Municipal Elec Lt Co, Brooklyn, N. Y.
Field, C. J., Standard Fire Proofing Co, New York.
Field, C. I., Port Jervis Elec Ry & Lt Co, Port Jervis, N. Y.
Farris, W. J., General Elec Co, Chicago.
Francis, Robt. W., Contractor Chicago Edison Co, Chicago.
Farris, Thos. H., General Electric Co, Milwaukee.
Field, A. W., Columbus Edison Elec Co, Columbus, O.
Finney, W. B., Chicago Edison Co, Chicago.
Frank, Jacob, Commopolitan Elec Co, Chicago.
Fraser, R. H., Des Moines Edison Lt Co, Des Moines, Ia.
Faker, J. G., Oklahoma City, O. T.
Floy, Henry, Westinghouse Elec & Mfg Co, Minneapolis.
Frank, S. S., Western Electric Co, Chicago.
Fujioke, I., Japan Elec Light Association, Tokyo, Japan.
Frith, Harry J., Watseka Elec Lt Co, Watseka, Ill.
Gordon, Thos. S., Chicago.
Grier, Edward B., Bryant Electric Co, Chicago.
Grier, Thos. C., Western Electric Co, Chicago.
Goehst, J. H., Chicago Edison Co, Chicago.
Gage, Channing T., Washburn & Moen Mfg Co, St. Paul Minn.
Garrison, A. C., Columbia Inc Lamp Co, St. Louis.
Gillmor, Elmer W., Warren Elec & Spec Co, Warren, O.
Gregory, John M., City Electric Light, Bellefontaine, O.
Gilbert, L. H., Jonesville Elec Lt & Pow Co, Jonesville, Mich.
Greenwood, C. H., Edison Lt & Power Co, La Crosse, Wis.
Hine, Wm. S., Stanley Elec Mfg Co, Chicago.
Harrington, Walter E., Camden & Suburban Ry Co, Camden, N. J.
Harrington, Walter E., Mrs., Camden, N. J.
Habrshaw, Dr. Wm., India Rubber & G P Ins Co, New York.
Hollister, J. M., Western Electric Co, Chicago.
Hagan, Edward M., Southwark Foundry & Machine Co, Chicago.
Hunt, Chas. B., London Electric Co, London, Ontario.
Hart, Jr., F. D., Pineville Elec Lt Co, Chicago.
Harris, Jr., B. F., Urbana & Champaign Ry, Gas & El Co, Champaign, Ill.
Hixson, H. R., Simplex Electrical Co, Chicago.
Holt, Thos., Smith Hill Elevator Co, Quincy, Ill.
Hart, Jr., F. D., Pineville Elec Light Co, Pineville, Ky.
Hanley, W. J., General Electric Co, Cincinnati.
Hubbard, W. M., The Bradford Belting Co, Cincinnati.
Hays, W. F., General Electric Co, Cincinnati.
Holcomb, Eugene, Holcomb & Green Elec Co, Springfield, Ill.
Hull, J. W., Cabinet Manufacturing Co, Steubenville, O.
Hubley, Wm., Louisville Elec Lt Co, Louisville, Ky.
Hold, W. F., Chicago General Fixture Co, Chicago.
Hapeman, Douglas, Thomas Elec Lt & Power Co, Ottawa, Ill.
Humphrey, H. H., Bryan & Humphrey, St. Louis.
Insull, Samuel, Chicago Edison Co, Chicago.
Jennings, John J., Wilkinsburg Elec Co, Wilkinsburg, Pa.
Jackson, Geo. T., National Conduit & Cable Co, New York.
Johns, S. O. D., Cleveland Elec. Ilg Co, Cleveland, O.
Johnson, Edw. H., Sprague Electric Co, New York.
Johannesson, J. E., Wagner Elec Mfg Co, St. Louis.
Jones, Geo. H., Chicago Edison Co, Chicago.
Kammeyer, C. E., Electrical Review, Chicago.
Kimball, Fred M., General Electric Co, Boston.
Kohler, G. A., Kohler Bros., Chicago.
Kitt, M. B., Sprague Electric Co, Chicago.
Kittie, E. B., Sprague Electric Co, Chicago.
Kelsch, R. S., Lachine Rapids Hydraulic & Land Co, Montreal, Canada.
Korst, P. H., Badger Electric Co, Ltd, Racine, Wis.
Keck, T. P., Brush Elec Lt Co, Savannah, Ga.
Kelly, W. E., Western Electrician, Chicago.
Kimbrough, U. C., Muncie Elec Lt Co, Muncie, Ill.
Kingan, W. P., Edison Sault Elec Co, Sault Ste Marie, Mich.
Knox, J. M., Central Electric Co, Chicago.
Lemie, E. A., Manhattan Elec Lt Co, Ltd, New York.
Livsey, J. H., General Electric Co, Detroit, Mich.
Liebrook, C. L., Chicago Edison Co, Chicago.
Lowell, James O., Bay County Elec Co, Bay City, Mich.
Lloyd, Herbert, Elec Storage Battery Co, Philadelphia.
Layman, W. A., Wagner Elec Mfg Co, St. Louis, Mo.
Loe, wood, Jos. D., Michigan Elec Co, Detroit, Mich.
Luke, J. B., U S Elec Lig Co, Washington, D. C.
Luthy, G. G., Royal Electric Co, Peoria, Ill.
Lewis, Theodore, Graham, Chicago Edison Co, Chicago.
Long, Geo., Chicago.
Mustard, John, Wagner Elec Mfg Co, Philadelphia.
Mitchell, O., Muncie, Ind.
Mahony, Gerald, Lakon Co, Elkhart, Ind.
Morse, S. F. B., Chicago.
McGhie, J., General Electric Co, New York.
Mercein, Thos. R., Sec Northwestern Elec Association, Milwaukee, Wis.
Marshall, N., Anchor Elec Co, Boston.
Moser, Chas., Dearborn Elec Co, Chicago.
McQuiside, Jas. P., National Conduit & Cable Co, New York.
Mier, A. M., Red Oak Elec Co, Red Oak, Iowa.
Morrell, J. B., Evanston Elec Ilg Co, Evanston, Ill.
Morgan, H. B., Jewell Belting Co, Chicago.
Manson, Geo. T., Okonite Co, New York.
Mallock, E. V., Laclede Power Co, St. Louis, Mo.
Marsh, Converse D., Bryan-Marsh Co, New York.
Morse, A. M., Atlas Engine Works, Chicago.
McGill, T. Julian, Westinghouse Elec & Mfg Co, Chicago.
Mold, Wm. S., Star Electric Co, Dubuque, Iowa.
Neal, Geo. B., Charlestown Gas & Electric Co, Boston.
Norcross, E. P., Jacksonville, Wis.
Obermeyer, Chas. B., Electric Appliance Co, Chicago.
O'Hara, J. B., Western Electrician, Chicago.
Porter, Geo. F., Kerite Wires & Cable, New York.
Pinlott, W. E., Sargent & Lundy, Chicago.
Pyle, Jas. E., Edison Ilg Co, West Chester, Pa.
Prentiss, R., General Electric Co, Philadelphia.
Pratt, Chas. A., Chicago.
Perkins, C. G., Perkins Switch Mfg Co, Hartford, Conn.
Pritchard, W. R., Westinghouse Co, Chicago.
Price, Chas. R., New Bedford Gas & Edison Co, New Bedford, Mass.
Pillbury, Edw., Wagner Elec Mfg Co, St. Louis, Mo.
Pratt, Fred S., Cumberland Elec Lt & Pow Co, Nashville, Tenn.
Page, A. D., General Electric Co, Newark, N. J.
Perry, C. C., Indianapolis Light & Power Co., Indianapolis, Ind.
Price, Chas. W., Electrical Review, New York.
Patterson, M. E., Chicago.
Rice, C. W., Kings Co Elec Lt & Power Co., Brooklyn.
Rosenthal, Geo. D., General Elec Co, St. Louis.
Redman, Geo. A., Brush Elec Lt Co, Rochester, N. Y.
Redman, Geo. A., Mrs., Rochester, N. Y.
Rockwood, G. O., Rockwood Mfg Co, Indianapolis, Ind.
Robinson, D. P., Edison Elec Ilg Co, Baltimore, O.
Robertson, A. N., Minneapolis General Elec Co, Minneapolis, Minn.
Ross, C. A., Sawyer Mfg Elec Co, Chicago.
Reeves, G. W., Johnstown Elec Lt Co, Johnstown, Pa.
Rober, Jno. C., Dayton Elec Lt Co, Dayton, O.
Rogers, L. H., Fort Wayne Lamp Co, Cleveland, O.
Rose, E. M., Farmington Ee Lt Co, Farmington, Ill.
Ray, Wm. D., The Johnson Co, Chicago.
Roehl, Chas. E., St. Joseph Ry, Lt, Heat & Pow Co., St. Joseph, Mo.
Shay, J. H., Chas Munson Belting Co, Chicago.
Stern, M. L., The Denver Consol Elec Co, Denver, Col.
Soovil, Samuel, Cleveland, O.
Scheffer, G. A., Diamond Electric Co, Peoria, Ill.
Schayer, John J., Commonwealth Electric Co, Chicago.
Shaw, A. C., Electrical Engineer, New York.
Shain, Chas. D., Weston Electrical Instrument Co., New York.
Schuchardt, R. F., Meyenberg & Badt, Chicago.

Smith, O. R., Manhattan Lt. Heat & Power Co., St. Paul.
 Smith, T. R., Wood, Sumner Electric Light Co., Boston.
 Smith, W. S., Toledo Consolidated Electric Co., Toledo, O.
 Smith, William M., Chicago Insulated Wire Co., Chicago.
 Shainwald, J. O., Standard P. Int. Co., Chicago.
 Smith, H. S., Sawyer Mfg. Elec. Co., Pittsburg.
 Swet and, H. M., Power Publishing Co., New York.
 Steringer, Luther, N. Y. York.
 Swanson, John, Hullsok Mfg. Co., Chicago.
 Scribner, J., General Electric Co., Chicago.
 Stetson, George R., New Bedford Gas & Edison Light Co., New Bedford, Mass.
 Smith, F. E., Lynn & Boston St. Ry. Co., Boston.
 Stearnes, R. S., Ft. Wayne Elec. Corp., New Orleans.
 Tompkins, W. H., City Elec. Ltg. Pl. t. Niles, Mich.
 Tregg, Chas. H., Hopston Elec. Co., Hopston, Ill.
 Trauman, E. E. R., Engineering News, Chicago.
 Tailleux, George, Chicago Edison Co., Chicago.
 Thayer, George L., Belle Plaine El. Lt. Co., Belle Plaine, Ia.
 Trump, S. N., Wilmington City Elec. Co., Wilmington, Del.
 Thorne, J. J., Electric Engineering Co., Bay City, Mich.
 Taylor, Frank H., Aesthoushouse Elec. Mfg. Co., Pittsburg.
 Torbert, H. G., Dubuque Light & Trac Co., Dubuque, Ia.
 Towner, H. L. G., Electric Appliance Co., Chicago.
 Uptegraft, J. W., Sewickley Electric Co., Sewickley, Pa.
 Truquhart, B. F., T. H. Carbon Co., Boston.
 Upham, W. P., Central Electric Co., Chicago.
 Van Trump, C. R., Wilmington City El. Co., Wilmington, Del.
 Varney, G. E., Indianapolis, Ind.
 Wells, R. S., Shelbyville Water & Lt. Co., Shelbyville, Ill.
 Wells, Ed. F., Shelbyville Water & Lt. Co., Shelbyville, Ill.
 Wilmerling, C. H., Chicago Sectional Underground Electric Co., Chicago.
 Wiley, J. R., Standard Underground Cable Co., Chicago.
 Whyte, George S., Fischer-Macomber Whyte Co., Chicago.
 Wells, C. J., Electric Appliance Co., Chicago.
 Wilkinson, C. D., Western Electric Co., Chicago.
 Walbank, W. M., Lachine Rapids Hydraulic & Land Co., Montreal, Can.
 Wade, E. E., El Paso Electric Co., Colorado Springs, Col.
 Wells, H. S., Smith Hill Elevator Co., St. Louis, Mo.
 Wagner, Herbert A., Missouri Edison Elec. Co., St. Louis.
 Wright, Peter, Virginia Elec. Co., Norfolk, Va.
 Watrous, A. W., Chas. A. Schieren & Co., Chicago.
 Wood, Elmer E., American Electrician, New York.
 Wyant, Robert E., Derby Gas Co., Derby, Conn.
 Woodrow, C. E., Sioux City, Iowa.
 Weeks, Edw. R., Kansas City Elec. Lt. Co., Kansas City, Mo.
 Warren, Arthur, Westinghouse Elec. & Mfg. Co., Pittsburg.
 Williams, Jno. R., Elec. Storage Battery Co., Philadelphia.
 Wetzler, Jos., Electric Engineer, New York.
 Wetzler, Jos., Mrs., New York.
 Wondle, G. E., Locomotive Elec. Co., Williamsport, Pa.
 Woodbridge, J. F., Electrical World, New York.
 Windsor, H. H., Street Railway Review, Chicago.
 Wilkens, E. W., Partrick, Carter & Wilkens, Philadelphia.
 Woodling, Elmer, Logansport, Ind.
 Webb, A. F., American Carbon Co., Noblesville, Ind.
 Webb, H. E., Solar Carbon & Mfg. Co., Pittsburg.
 Young, S. March, Manhattan General Const. Co., New York.
 Young, E. P., Sewickley, Pa.
 Young, Jno., Western Electric Co., Chicago.
 Yates, A. C., Newton, Iowa.

MIDSUMMER MEETING OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

On Board Steamer North West, Chicago to Duluth, Beginning June 10, 1898.

The Convention was called to order at 8 p. m. for the purpose of arranging a programme.

The Secretary announced that stops would be made at Mackinac, the "Soo," and at Houghton, and that it was expected the steamer would reach Duluth Monday night, June 13; that there would be a reception tendered the members of the Association at Sault Ste. Marie, and that there would be an inspection of the Government canal especially arranged for the benefit of the members of the Association; that there would also be a stop made at Houghton long enough to permit of a tour of the famous copper mines there, and that suitable arrangements had been made for that purpose; that the only requisite would be an Association badge, which he was prepared to furnish to the members of the Association and to guests at a nominal price.

Professor I. Fujioka, of Tokyo, Japan, who has been sent by the Japanese Government to the United States for the purpose of investigating electrical progress here, was called upon for an address, and said:

"I do not wish to address the Convention at length this evening, but if it is desired will at some future session say something on the subject of the electrical industry in Japan, adding some comments on the subject of electrical education there, as I think that these topics will be of some interest to you all, and as I am naturally, perhaps, more familiar with the situation of electrical matters in Japan than most of the gentlemen here could be expected to be."

This remark of Mr. Fujioka was greeted with good-humored acquiescence.

It was announced that Professor Elisha Gray of

Highland Park, Illinois, would deliver an address during the Convention, at an early session.

The programme for the next regular session was made out, consisting of a paper on the subject of "Incandescent Lamps," by Mr. S. Everett Doane, the session to be held at 11 A. M. June 11.

The Secretary announced also that an address would be delivered by Mr. A. J. Werts of Pittsburg at some session during the trip, and that other addresses would be announced later.

Announcement was made that W. F. Barker, Gas Commissioner of Massachusetts, would also deliver an address.

Arrangements were made to place a question box in position to receive queries for consideration and discussion during the sessions.

An adjournment was then taken until June 11 at 11 A. M.

The following is a list of the members of the Association and their guests on the steamer North West, Chicago to Duluth:

President F. A. Copeland, La Crosse, Wis.
 Secretary Thomas R. Merozin, Milwaukee, Wis.
 J. N. Ely, Atlanta, Ga.
 B. B. Downs, Minneapolis.
 W. P. Upham, Chicago.
 A. L. Daniels, Aultman, O.
 C. D. Wilkinson, Chicago.
 W. S. Rugg, Chicago.
 Douglas Hapeman, Ottawa, Ill.
 R. A. Willson, Marquette.
 Robert F. Carr, Chicago.
 Arthur Warren, Pittsburg.
 J. W. Mabbs, Chicago.
 C. S. Kehler, Chicago.
 E. H. Abadie, St. Louis.
 Charles P. Williams, La Crosse.
 J. B. Kuntson, La Crosse.
 John S. Baker, Evansville, Wis.
 Miss Eliza Cleland, Evansville, Wis.
 Fred Brooks, Boston, Mass.
 Morgan Brooks, Minneapolis.
 L. S. Randolph, Blacksburg, Va.
 Herbert H. Dow, Midland, Mich.
 J. W. Hull, Steubenville, O.
 H. H. Brooks, Boston.
 J. H. Harding, La Porte, Ind.
 Samuel Wilkinson, Northville, Mich.
 R. M. Heskett, Green Bay, Wis.
 Charles F. Frego, Hoopeston, Ill.
 James H. McGraw, New York.
 F. L. Perry, Chicago.
 P. H. Kerst, Racine, Wis.
 W. D. Packard, Warren, O.
 L. K. Comstock, Chicago.
 H. C. State, Milwaukee, Wis.
 Wm. Chandler, Sault Ste. Marie.
 C. A. Ross, Chicago.
 C. Dysturd, Monterey, Mex.
 Geo. V. Williams, Chicago.
 Geo. Rex, St. Louis.
 A. G. Paul and wife, Chicago.
 H. S. Anderson, Springfield.
 George A. McKintock, Chicago.
 W. L. Candee, New York.
 Elisha Gray and wife, Highland Park, Ill.
 A. E. Lang and wife, Cleveland, O.
 A. J. Werts and wife, Pittsburg.
 W. F. Barker, Boston, Mass.
 Mr. Whitney.
 Iohisuke Fujioka, Tokyo, Japan.
 Mr. Fitzgerald and wife, Duluth.
 W. B. Banks, Superior, Wis.
 Mayor Truelsen, Duluth, Minn.
 O. C. Hartman, Duluth.
 C. F. Leland, Duluth.
 F. L. Taylor, Duluth.
 O. H. Simons, Duluth.
 H. E. Smith, Duluth.
 Mayor Dietrich, West Superior.
 Mr. Perrin, West Superior.
 A. A. Cross, West Superior.
 Mr. Scanlon and wife, Milwaukee.
 W. M. Lowerie, Chicago.
 W. H. Friend and wife, Vincennes.
 G. T. Manson, New York.
 S. C. D. Johns and wife, Cleveland, O.
 B. J. Arnold and wife, Chicago.
 Thos. J. Stacey, and wife, Chicago.
 Jos. Wetzler and wife, New York.
 J. M. Hill and wife, Chicago.
 Mrs. S. D. McDonald, Chicago.
 H. G. Underwood and wife, Milwaukee.
 H. Hergett and wife, Pekin, Ill.
 H. D. Goodwin and wife, Milwaukee.
 Hugo P. Goodwin, Milwaukee.

M. L. Stern, Denver, Col.
 S. Scovill and wife, Cleveland, O.
 Miss Parker, Evanston.
 H. C. Maloney, Chicago.
 J. J. McDonald, Chicago.
 J. J. Schayer, Chicago.
 H. A. Wagner, St. Louis, Mo.
 Mrs. Perry, Chicago.
 J. Jennings, Wilkinsburg, Pa.
 Thos. Ferris, Milwaukee.
 F. M. Kimball, Boston, Mass.
 H. F. Edgar, Boston, Mass.
 W. W. Dailey, Chicago.
 Max Bass, Chicago.
 Wallace O'Connor, Chicago.
 H. M. Atkinson, Atlanta.
 E. B. Kittle, Chicago.
 F. N. Boyer, Chicago.
 L. J. Densberg, Sault Ste. Marie.
 W. F. Kingman, Sault Ste. Marie.
 S. E. Doane.
 Converse D. Marsh, New York.
 W. C. Knight, Ft. Wayne.
 W. S. Smith, Toledo.
 F. N. Phillips, Providence, R. I.
 F. E. Donohoe, Chicago.
 Mr. Woodbridge, New York.
 C. W. Price, New York.
 J. S. Church, Chicago.
 James R. Dee, Houghton, Mich.
 Henry L. Doherty, Madison, Wis.
 A. D. Page.

Illinois Street Railway Association.

The second annual meeting of the Illinois Street Railway Association was held in Chicago on the 7th, 8th and 9th inst. Representatives of nearly all the street railroad companies in Illinois were present, and the papers read and discussions which followed showed that the railway men of the State are possessed of sufficient ability to guard the interests entrusted to their charge. The papers on the programme were of a specially practical nature and the subjects were treated with intelligence and good judgment. The authors and titles of the papers were as follows:

"On the Rights of Street Railways Under the Constitution." C. L. Bonney, Chicago.

"On Operation of Street Railways in Small Cities." E. X. Lesseure, Danville, Ill.

"System of Collection of Fares and Checking Employees." W. L. Ferguson, Decatur, Ill.

"Relations of Street Railways and Municipal Corporations." D. B. Sherwood, Elgin, Ill.

Mr. Bonney's paper was the feature of the meeting. In it he stated that the attitude of the city of Chicago toward its car lines was indefensible and amounted to oppression. He advised street railway companies when their rights were assailed by the councils or the Legislature to carry their grievances to the federal courts.

Personal.

It will be of interest to the general public hardly less than to the electrical fraternity to know that Lieut. Frank J. Sprague, who has for the last six weeks been confined to his house, and in great suffering, from a severe injury to his right eye, is in a fair way to recovery. Nearly two months ago a piece of the eyeglass Mr. Sprague was wearing was accidentally forced into the ball of the eye, and Mr. Sprague had to remain for some two weeks under the care of a specialist. Being very anxious to push forward to definite shape the Volunteer Corps of Electrical Engineers, which he offered some time ago to organize for early service at the front, Mr. Sprague imprudently went to Washington, where he caught cold in the injured eye. Severe complications set in, along with iritis, and for some time it was feared that blindness was inevitable. This danger however seems to have passed, and there is every prospect that Mr. Sprague will soon be able to renew his active part both in the affairs of the company with which he is identified and the formation of a fighting corps that should fill a place of its own in the war resources of the Government.

THE X-RAYS AND THEIR SAFE APPLICATION.*

Destruction of X-Ray and Other Infections by Electro-Sterilization.

BY J. MOUNT BLEYER, M. D., F. R. A. M. S., LL. D.,
New York City.

The discovery of new properties of the X-rays go on apace and the scientific world is closely watching to determine any new effect of these rays upon the human body. Since their discovery and their application in medico-surgical work, reports have spread throughout the profession and the lay public of a grave danger accompanying the use of these X-rays owing to their producing so-called virulent burns by exposure to them. Many cases of such burns are on record, differing in degree, some having even proven fatal from a lingering exposure to the rays. The records tell us of a recent murder trial in this State in which the question arose as to whether death was not due to an act of negligence on the part of the physician who made the X-ray exposure. Let me say at the outset that from what I have gathered from my experimental work all your timidity in the use of X-rays may be allayed. The conclusions which I have arrived at are, that if the X-rays are applied with certain precautions no danger exists. I speak now of the actual daily applications of these rays to the chest-wall with a view of gaining early diagnostic signs of tubercular and other allied diseases if present.

This investigation gives me the right of an opinion, and I freely express it before you to show how we all have fallen into a fallacious position by calling this phenomenon as produced by X-rays burns, when it is nothing more nor less than an inoculation. Now that we know how to guard against the danger attending their use, how best to avoid the repetition of mistakes, and who the blame should rest on if the proper precautions are not observed.

I shall again refer to these facts in a few moments. Let me eliminate from your minds that an X-ray application or the use of its photography is a dangerous procedure either on a long or short exposure. If this force when applied is handled by skilled hands, a suitable mechanism used, there is absolutely no danger to be feared from this phenomenon of inoculation known fallaciously as X-ray burns.

This inoculation is due, according to my observation during a series of experiments, to several physical effects produced by the generation of these rays and the general conditions present. It is a known fact that the Ruhmkorff coil if used in connection with the generation of these rays is an apparatus which gives an exceedingly high electromotive force and amperage, and whose discharges produce certain physical conditions surrounding the atmosphere of the patient or person exposed to these X-rays. We find that this high discharge when leveled against the subject carries with it from the surrounding atmosphere particles floating therein, and is also surcharged with bacteria and foreign material found upon the clothing and skin of the subject, setting up under the skin exposed to this phenomenon sometimes an infectious and at other times an inflammatory condition from these force-driven materials.

This inflammatory or inoculated condition is the result of the facts set forth above, as I discovered during my investigations, and can be avoided without difficulty now on the part of the operator by the adoption of a few rules gleaned from my experience which I shall give in the summing up of my remarks.

I bring before your notice a few most important facts which are corroborated by others as well as by my personal investigations. These facts cannot fail to be appreciated as they come from several late

observers who have studied the question of burns due to fire, hot water, etc., and the causes of death therefrom.

We already know that many deaths are due to burns produced by other causes than the X-rays. It has puzzled scientists to account for deaths which occurred among persons suffering from burns, even where the injuries received seemed wholly inadequate to produce fatal results. The havoc caused by skin diseases might be much greater and a far larger surface of the skin attacked, but generally a cure could be effected, whereas in the majority of cases of severe burns the end would be fatal.

Persons who have escaped with their lives from a fire, whether severely burned or otherwise, suffer intense pain, which is followed by a peculiar torpor and drowsiness, and not infrequently by delirium and convulsions. The pulse becomes weak, the breathing irregular, the temperature lower, and there almost always follows vomiting and other symptoms of poisoning, terminating within twenty-four to twenty-eight hours in death.

Although these symptoms have received the attention of a number of scientists, their views as to the actual cause of death were widely diverse. The first guesses though ingenious were very far from the truth. A German, F. Falk, arrived at the conclusion that persons suffering from burns died of cold caused by the abnormal amount of heat given off through the burned portions. Prof. Ponfils, on the other hand, believed the cause to be the destruction by the heat of a great number of blood corpuscles, inducing a disturbance of the circulation. Addakoff, a Russian physician, stated as his view, gained from clinical observations, that the result of burns upon the system bore a resemblance to the effects produced by certain poisons, particularly those generated in the body by the failure to throw off secretions. Lustgarten and Kijanitsin come still nearer to the truth, the former comparing the results of burning with that of ptomaine poisoning, and the other declaring that under some influence or other, probably that of a ferment of bacteria, a poisonous matter developed in the blood of burnt persons. He actually found in the blood of such persons a poison (ptomaine) that is not present in normal bodies. It is a formless, yellowish or brownish yellow matter, with a sharp disagreeable odor, and injected into dogs or rabbits produces all the symptoms caused by burning. The belief of Lustgarten that bacteria, causing impurities which settled in the wound, were the generators of the poison, was shown by the experiments of Ajello and Parascandolo to be unfounded. Both these were able to take from any part of the body of a burnt animal a poison, the injection of 10 grammes of which into a dog weighing twenty pounds produced instant death. The strongest poison was obtained from the burned flesh, a lesser was in burned entrails, and the weakest of all came from the blood.

From this may be deduced with certainty that the ptomaine is not solely in the blood but in the whole of the burned portions and is thence carried into the system. Burnt persons poison themselves, so to speak.

The poison may be regarded as the product under the influence of high temperature of the albumen and the direct impregnation of bacterial poison from without, etc. It has been found possible, however, to prevent poison from spreading by removing the burned portions before the ptomaine had entered the circulation. It is also known from Ajello and Parascandolo's experiments with animals that all recovered without having suffered from the symptoms incidental to burns when the amputation of the burned parts occurred immediately after the burns were received. Where the amputation was delayed for twenty-four hours they all succumbed, except in instances where large quantities of blood were removed by bleeding; the blood drawn off being replaced, however, by a transfusion of pure

blood. By the bleeding a large quantity of the poison was removed, the blood artificially supplied so strengthened the animals that there was facilitated a further separation of the poison from the blood by means of the kidneys.

I lay much stress upon this important point due to these X-ray phenomena, that the X-ray burns always appear many days after the application of this force or light to a part of the body and do not show absolutely any early manifestation, minutes or hours thereafter, but days elapse, even as late as 18 days thereafter. These X-ray burns begin with a painful dermatitis and slowly develop symptoms resembling burns from heat or scalded. It is therefore seen that from the very outset the clinical difference in the conditions is apparent.

How should we avoid this dangerous condition in the application of the X-ray?

To sum up the whole matter, let me say in a few words the following, viz.:

Above all, substitute the static machine for the Ruhmkorff coil. This form of electricity has not the physical properties of carrying foreign material into the depths of tissue so readily as the other current. Static electricity gives only the high voltage with low amperage, while the other is productive of both high forces making it an unnecessarily dangerous appliance.

All parts to be either photographed or examined by means of these X-rays should have all clothing removed therefrom, and be washed with an antiseptic solution or so prepared as if a surgical operation was to be performed. Also a room which is as free as possible from infectious materials should always be made ready, or specially appointed for the purpose. These are the cardinal rules, and must not be deviated from, in order to avoid a dangerous inoculation or poisoning.

Specific Treatment for Such Conditions.—Should such a condition arise, from unforeseen causes or otherwise, sterilization of the affected part by means of electrolysis is the safest and quickest specific known to me, with the amputation of loose tissue surrounding the parts. I found in my early work, as far back as May, 1896, when I had been as unfortunate as others in inflicting these burns on several patients, that something more was present to deal with than an ordinary electro-dermatitis. Experimental study of the question soon elicited facts that brought me to the discovery of the following remedial agent which I recommend to your notice. Electrolysis or sterilization of the parts is a specific. The current decomposes all the infected materials and changes them into some other non-poisonous compound, thereby relieving the system of poisonous products. This is accomplished by placing such parts of the body into a salty solution of distilled water and connecting the electrode with the negative pole of a galvanic battery with a milliamperemeter. The positive pole may be placed on any convenient part of the subject. Vessels of porcelain, wood or glass are best. The strength of this current should average 5 milliamperes to a square inch of surface to be sterilized, lasting at least half an hour; after that time the polarity should be reversed for five minutes in order to set free the chlorine which will again react on all the external and internal exposed surface. As serious conditions will arise unless one knows the exact amount of current passing, accurate measuring by means of a milliamperemeter with the use of such current must be strictly adhered to, so as to judge the exact quantity of chemical action, thereby controlling its destructive effects, which if not known will do serious injury to healthy surrounding tissue.

I know of no more satisfactory and scientific method in the treatment of these X-ray wounds, and in fact all deep and superficial wounds, than the sterilization by electricity as advocated in my method. All other kinds of wounds containing pus should first be drained by incision before the above procedure is

* Read before the Medico-Legal Society, Psychological Section, May 26, 1898.

undertaken. I must state in my recommendation of sterilization by electrolysis to those who may hereafter apply it that they should at least be acquainted with the fundamental principles involving electrochemistry. Good judgment is necessary, as much damage can be done if proper precautions are not observed. The time of application must always be left to the discretion of the operator, especially in deep-seated conditions. Reapplications can always be resorted to. There are no contra-indications for this treatment by electrical sterilization to any class of infected wounds and skin diseases presented to surgery. After such treatment protective dressing of a simple kind is necessary to keep the parts from further infections.

I bring my new and novel investigation before your notice for the first time, and hope that it will find its way into general surgery with as much and better satisfaction than the methods heretofore employed and give as good account of itself as it has in my hands.

This work has been the outcome of early results obtained by me in the treatment of tuberculosis and several other inflammatory diseases of the lungs, etc., which still occupies my time with results already most fruitful.

My investigations brought me to a most important point, and that is that all microscopic crevices are cleaned of bacilli and pus cells, while in the use of antiseptic solutions, etc., a mere coating is effected thereby, leaving it always liable to a re-infection. This form of sterilization does not absolutely admit of such a condition, as destruction takes place instantaneously by chemical decomposition; also by reversing of the polarity of this current, these microscopical crevices are again closed completely by its electro-dynamic action.

Electro-sterilization must be highly recommended as a prime antidote to all kinds of stings, dog bites, or in fact venomous wounds produced by serpents. In such cases, however, the current should be applied a much longer time than for ordinary cases.

I beg to acknowledge the assistance received from Dr. H. T. Waits during my experimentation.

A New Electrical Thermometer.

At a recent meeting of the Frankfort Electrical Society Herr F. Heitmann described a new electrical thermometer constructed by Messrs. Hartmann and Braun of Frankfort. In principle it resembles a Bruger direct-reading ohmmeter. Two crossed coils are free to rotate in a strong non-homogeneous magnetic field. In circuit with one is a resistance of fixed value, and in circuit with the other is the resistance to be measured—in this case the temperature wire. The scale of the instrument is graduated to read directly in degrees. The apparatus can be made for any range of temperatures, and by adjusting the shape of the pole pieces it is possible to produce an "open scale" in the neighborhood of any particular temperature. A platinum wire is used for high temperatures, and a "nickelin" wire for lower ones. Temperatures up to 1,200° C. can be measured with the instrument, and it is stated that it can also be used with similar accuracy for temperatures below 0° C. The current required is only about 0.03 ampere at about 5 volts, and the instrument can be left constantly in circuit without injury.

CANADIAN NOTES.

The eighth annual meeting of the Canadian Electrical Association is to be held in Montreal on June 28, 29 and 30. Headquarters will be at the Windsor Hotel, and already accommodation has been provided in the city for 150 members. A large number of papers by prominent men and of interest to the members will be read. The Convention will visit in a body the electrical works at Lachine Rapids and at Chambly.

The Canadian Pacific Railroad copper telegraph

line from Montreal to Vancouver, B. C., is being strung in three divisions—to Fort William, thence to Donald, B. C., thence to the coast. A great deal of trouble has been experienced by telegraphic companies by reason of wires coming in contact with each other through the breaking of the glass insulators by which the wires are attached to the poles. A test was therefore made at McGill University, Montreal, with a view to ascertaining the comparative resistance of glass and porcelain insulators, with the result that it was found that porcelain resisted much heavier and a greater number of blows than the glass. The testing of the wire is also going on at the Applied Science Department of McGill, from samples taken at random from bundles of ten as they are manufactured by the Dominion Wire Company. The wire must be .137 of an inch in diameter, perfectly cylindrical and weigh 300 pounds to the mile, four pounds of a variation being allowed in this distance. Frequent electrical tests are made upon pieces one one-hundredth of a mile in length to determine the purity of the copper used, which must be 97 per cent. Each bundle weighs 170 pounds, and the wire must be in one continuous length, without joint or break. Each six inches of wire will stand 50 twists of 1 twist a second before breaking and an average breaking strain of 970 pounds and stretch 1 per cent. before breaking. When completed there will be a length of about 2,900 miles of wire.

Mr. J. W. Scott, an enterprising citizen of Napanee, Ont., has closed a contract with the Canada General Electric Company for a 100 kw. 4,000-volt three-phase generator of the revolving field type, for the purpose of supplying light and power to the town of Napanee from a water-power 8 miles distant from the town. He will also supply light and power to intermediate points.

LEGAL NOTES.

Judge Daly, on the application of Geo. J. Schoeffel, a judgment creditor, has appointed Charles Donohue receiver of the property in New York State of the Ogley Electric Company, which formerly had an office in the city of New York and a factory in Jersey City. Mr. Schoeffel learned that the company has assets in New York City consisting of notes aggregating \$37,500 against which there is a claim for \$13,773. The receiver was appointed here to collect the notes and apply the proceeds to the satisfaction of the claims.

The Supreme Court of New Jersey on the 8th inst. handed down a decision upholding the action of the city council of Atlantic City in awarding a contract for lighting the city for a period of five years to John H. Kothermel, of Reading, Pa.

The Superior Court at Tacoma, Wash., has handed down a decision in favor of the city in the suit of the Tacoma Gas & Electric Light Company against the city of Tacoma to restrain the latter from selling certain property formerly belonging to the Tacoma Light & Water Company. An injunction restraining the sale is dissolved by the decision. The suit arose over the alleged fraudulent sale of the water works to the city, and the latter was awarded a judgment amounting to nearly \$1,000,000, and seeks to recover by selling the property of the former light and water company.

Judge Townsend in the United States Court at New Haven has granted the Electric Car Company of America a stay of proceedings in order to get further testimony in the suit of the Thomson-Houston Company vs. the Hartford & West Hartford Railroad Company. The suit was brought for infringement of patent No. 393,323, pertaining to improvements in switches for electric motors.

In the United States Circuit Court for the Southern District of New York, Judge Lacombe has granted to the Consolidated Car Heating Company a preliminary injunction restraining the Gold Car Heating Company from the further manufacture, use, or sale of a spiral coil electrical heating apparatus, the patent for which is claimed by the complainants to have been infringed by the Gold Car Heating Company. The court further orders that

the operation of the injunction shall be suspended until November 1, 1898, if the defendants file a bond for \$10,000 to secure the payment of any decree for damages and profits that may be entered.

Suit has been instituted in the Court of Common Pleas of Baltimore by the Virginia Electric Company of Baltimore against the Richmond Railway & Electric Company of Richmond, Va., through its vice president, George E. Fisher, for \$500,000. The plaintiffs obtained a thirty years' franchise from the Richmond city council to furnish and supply electric light and power last December. The company pledged itself to construct and erect such hydraulic work in and near James River as might be necessary to furnish water power to produce not less than 2,000 horse-power of electricity for the furnishing of electric power and light. They claim in their bill to have expended in surveys and experimental work the sum of \$20,000, and to have entered a large number of contracts. The managers of the Richmond Railway & Electric Company, they claim, had a strong interest in preventing the plaintiffs from carrying forward the development of the water power, which would have made the said plaintiff company a competitor of the defendant company in its business, and therefore continued to delay and to embarrass the plaintiff company and to prevent it from entering into relations with any other railway company or capitalist, and more especially to prevent its completing the conditional contract for the purchase of land and water rights within the time limited in said contract.

THE NEWS.

What Is Going On in the Electrical World.

LIGHTING PLANTS.

Belleville, N. J.—The township committee are considering the bids presented for lighting the town with electricity. James Hardman Jr., of Belleville, was the lowest bidder, at \$13.85 a light for the first year, \$13.50 on a three years' contract, and \$13 on a five years' contract. Mr. Hardman said he did not have a plant, but could be ready to furnish light in sixty days.

Durham, N. C.—There is a movement here in favor of putting in an electric light plant to be owned and operated by the city.

Elmira, N. Y.—The lamp committee of the common council has adopted a resolution looking to the establishment of a municipal lighting plant in Elmira, and will ask for authority from the council to provide for plans and specifications and advertise for bids for its erection.

Los Angeles, Cal.—The proposal to have the city erect and run its own electric lighting plant has brought out a healthy opposition, not the least of which comes from the oil men who have sent a protest to the council calling attention to the fact "that at least two electric light companies now operating in the city use the local oil as fuel in power production and that no plan or scheme should be urged upon the people of the city which will, for the sake of misleading and false economy, deprive us of an almost certain market of over one thousand barrels of oil per month."

New Castle, Wyo.—The council has granted a six years' franchise to C. A. Peterson for an electric light plant and made a contract with him for lighting the city for that length of time. The plant will be erected as soon as possible.

Macon, Ga.—The electric light plant of the Macon Gas, Light & Water Company was sold recently at public sale to the Macon & Indian Spring Street Car Company for the upset price fixed by the court—\$40,000. There were no other bidders.

Milwaukee, Wis.—The joint committee on finance and street lights have decided to refer the question of erecting a municipal plant to the committee on street lights.

Sioux City, Ia.—The city council has decided to discard the gasoline and gas lamps now in use in this city, and the light committee has submitted a report recommending that the city enter into a new contract with the Sioux City Electric Company and the Sioux City Gaslight Company.—The Sioux Rapids Electric Light & Mill Company's plants were burned on the 2d inst., with a total loss of \$25,000 and \$2,000 insurance.

Springfield, Minn.—The village council has closed a contract with the Fort Wayne Electric Corporation for additional lighting facilities.

St. Louis.—The power house of the Imperial Electric Light, Heat & Power Company is almost completed and will have a capacity of about 12,000 horse-power. The Imperial company is making contracts with consumers for periods of three to five years, and it is re-

ported that it will make an attempt to secure the city lighting contract.—The Carondelet Electric Light & Power Company has made an appeal to the mayor to stop, if he can, the furnishing of electric light by the railway companies of the city.

Toledo, O.—Electric light is to be re-introduced into the Government building, in place of Welsbach gas burners, which were put in less than a year ago. In the post office department especially the gas burners were objectionable because they raised the temperature several degrees.

STREET RAILROADS.

Albany, N. Y.—The contract for the construction of the Albany, Helderberg & Schoharie Electric Railway was awarded on the 2d inst. to the Albany Construction Company. The work will be begun in a few days, and within three months the road is to be in operation to a point beyond Thompson's Lake. It is stipulated in the contract that after the construction company has expended from \$10,000 to \$15,000 it shall have a majority representation on the board of directors of the railway company. The contract price is about \$1,000,000 and Boston capital is backing the construction company. W. H. Burgett of Boston is the president of the railroad company and Richard Schermerhorn of Brooklyn chief engineer. Mr. Schermerhorn is president of the construction company. The other directors of the railroad company are Charles E. Bibber, Herbert Smith, Charles Perkins, all of Boston; Benjamin M. Secor of Albany, Thomas Wood of Berne, C. G. Kromer and M. Twitchell of Schoharie, and J. M. Borthwick and R. J. McAuley of Albany.—The State Board of Railroad Commissioners have granted two of the applications recently filed by the Metropolitan Street Railway Company of New York City for authority to use the under trolley system on lines operated by it.

Anderson, Ind.—The Indiana Gas Belt Electric Railway is now in operation between this city and Summitville and Marion and Fairmount, leaving but five miles to connect up to complete the Marion-Anderson line. The Elwood line is well under way and the Muncie line will be started at once. The Indianapolis branch will be built this fall or early next spring. Congressman Henry is at the head of the system.

Bridgeport, Conn.—Andrew Radcliff, formerly of Newark, N. J., the president of the Bridgeport Traction Company, has just closed a deal whereby he practically becomes the sole owner of the Westport street railway line, one of the best equipped and most profitable of the Connecticut suburban lines.

Buffalo, N. Y.—The "Commercial" says: "Notwithstanding the denials which have been made by Herbert P. Bissell, Joseph B. Mayer and E. G. S. Miller, officers of the Buffalo Traction Company, it may be stated that the transfer of the company has been made, practically, through Ladenberg, Thallman & Co., of New York, who financed the Traction Company."

Chattanooga, Tenn.—The council has passed an ordinance limiting the franchise of the Chattanooga Electric Railway Company to twenty-five years, at the expiration of which time the value of the franchise will be reappraised by the mayor and aldermen.

Chicago.—The Union Transit Company, which has made application for a fifty-year franchise for about twenty miles of streets, is the successor to the rights of the Great Lakes Transit Company. This latter company was incorporated with a capital stock of \$6,000,000 August 7, 1883. The incorporators were Emanuel P. Barnett, Albert K. Norton and Frank E. Hayner, all Chicago lawyers. In April of last year the name of the company was changed to that of the Union Transit Company and the by-laws changed so that its purposes were increased from owning vessels on the lakes to operating street car lines. Frank T. Winslow was president of the company and Leonidas Connell secretary last year. Lucius Clark, late of the General Electric Railway Co., has now secured control of the charter.

Easton, Pa.—The Easton, Palmer & Bethlehem Electric Railway Company, composed principally of New England capitalists, has begun the construction of its trolley line, twelve miles long, connecting this city with Bethlehem. The company expects to have the road in operation by September 15.

Hartford, Conn.—The incorporators of the Suffield & East Granby Street Railway Company have accepted the charter granted by the last Legislature. At a recent meeting held here by-laws were adopted and an organization fully perfected. The capital stock is \$50,000.

Jersey City, N. J.—J. H. McGurty of this city, who claims to be the inventor of a new single-rail elevated railway system, is erecting a trestle for experimental purposes on the old reservoir site, and has invited a number of railway men and electrical experts to witness tests which he expects to be ready to make in a few days. The motive power of Mr. McGurty's railway is to be electricity and the motors will be beneath the cars. The inventor claims that cars can be run by his system safely at a speed of 100 to 120 miles an hour if necessary.

Lewiston, Me.—A. F. Gerald, who is associated with I. C. Libby in the projected electric railway connecting this city with Bath, thirty miles distant, says that they are getting on fairly well and expect to have the road ready for operation by July 1. The water power of the Cabot mills at Brunswick will be used to generate electricity for the trolley cars.

Lima, O.—A movement is on foot looking to the building of an electric line to connect this city and Delphos by way of Elida and Gomer, which would make a line

about eighteen miles long. A committee has canvassed the territory and met with success.

Lockport, N. Y.—The work of transforming the Erie's Lockport branch from Tonawanda to Lockport into an electric line is being pushed rapidly, and it is expected that all of the poles will be erected and wire stretched within another week. Trolley cars will be operated by the Buffalo & Lockport Railway on July 1.

New Haven, Conn.—The promoters of the Torrington & Hartford trolley project, involving a "cross country" line twenty miles long, have decided to open the books for subscriptions. The layout of the road is through pretty remote farm regions, where the land-owners have so earnestly desired the line that in some cases, it is said, they have not only given free right of way, but offered to supply ties and even do part of the grading.

Ottawa, Can.—The Senate has passed the bill to incorporate the North Shore Electric Railway Company.

Plainfield, N. J.—Civil Engineer Frank J. Hubbard, who has been employed by the Union County board of freeholders to prepare the maps and plans for the proposed widening of the boulevard between Plainfield and Elizabeth, in order to build a trolley road along the route under the provisions of the Squire law, has completed his work. It is estimated that the work cannot be accomplished for less than \$500,000, which sum it is calculated can be raised by the sale of the franchise for the trolley road to the highest bidder.

Quebec, Can.—The amalgamation of the Quebec, Montmorency & Charlevoix Railway and the Quebec District Railway Company is expected to take effect on or about June 30, after which work will be commenced upon applying electricity as the motive power of the former road.

Salem, Ore.—A deed has been filed in the recorder's office conveying the property of the Salem Consolidated Street Railway Company to the Salem Light & Traction Company.

Syracuse, N. Y.—The Rapid Transit Railway Company has decided to build several additional lines of railroad within the city limits.

Waco, Tex.—The Citizens' Street Railway Company having abandoned their College Heights line, a new company will be organized to take up this line and make it the first link in a proposed system.

Washington, D. C.—Arrangements have been made by which the Capital Railway Company will furnish the Chesapeake Beach Railway, of which Mr. Otto Mears of Denver, Col., is president, an entrance into the city of Washington. The latter road is now nearly completed from the District line to Chesapeake Beach. Mr. Mears says it is the intention of the Chesapeake Beach Company to expend at least \$1,500,000 in making improvements at the Beach and to spare no expense to make of the latter the finest resort on the Atlantic coast.

MANUFACTURING, ETC.

Charleston, W. Va.—The Secretary of State has issued a charter to the General Electric Automobile Company of Philadelphia, Pa. The capital subscribed is \$2,500 in shares of \$50, with the privilege of increasing the capital to \$2,500,000. The purpose is acquiring patents and inventions relating to the operation of electrical and mechanical appliances and doing a general manufacturing business. The shares are held by A. B. Pearson, C. E. Lent, J. E. Lewis, T. R. Heller and C. W. Cox. The charter expires March 23, 1943.

Fort Wayne, Ind.—The general agents of the Fort Wayne Electric Corporation assembled in this city on the 6th inst. Meetings of this kind are held once a year when the representatives of the corporation come together and discuss the business which is in their hands. They exchange views and much valuable information is passed around.

Indianapolis, Ind.—The Jenney Electric Motor Company has begun the erection of a large brick building on the ground where the works burned stood. The main building is 180 feet long by 60 feet wide.

New York.—The New York Insulated Wire Company, 15 Cortlandt street, is reported to have sold a few days ago \$50,000 worth of copper wire and rail binders for a trolley road connecting Yokohama with Odawara, Japan. The Glenwood Works of Youkers, through Mr. J. W. Godfrey, 15 Cortlandt street, has also recently sold large supplies of a similar kind to Japanese concerns. There is a large demand in Japan at the present time for electric railway supplies of all kinds.

Pittsburg.—The Westinghouse Electric & Mfg. Company has received an order from the Driggs Seabury Gun & Ammunition Company of Derby, Conn., for several 30-horse power motors for the electrical equipment of its shops, made necessary by the rush of Government war contracts. A big generator has also been ordered.

Washington, D. C.—The Navy Department, through the Bureau of Supplies, is inviting sealed proposals until June 23 for furnishing the New York Navy Yard with the following electrical equipment: One 100 k w. 125 volts generator, compound wound, direct current, complete; speed not to exceed 600 revolutions per minute. Six 2-horse power 110-volt enclosed portable motors, each motor to be mounted on 3 or 4 wheeled truck provided with 3 vertical screws by means of which the truck can be raised from the floor and held stationary when the motor is to be belted to machine tools. Two 5 horse power motors and two 10 horse power motors of similar design. One 20-horse power shunt wound 120-volt motor, complete; speed to be between

800 and 900 revolutions per minute. Prospective bidders desiring blank forms of proposals and additional information can obtain the same upon application to the Navy Pay Office, New York, or to Paymaster Edwin Stewart, Navy Department, Washington.

TRANSMISSION PLANTS.

Los Angeles, Cal.—The San Gabriel Electric Company has nearly completed its work of establishing a great electric plant in the San Gabriel Canyon, by which electric power is to be transmitted over copper wires to Los Angeles, twenty-two miles from the mouth of the canyon. It is expected that the line will be completed by the 15th of June, and its ultimate capacity will be 3,500 horse-power delivered, after deducting all losses in transmission. The water is conveyed through thirty-eight tunnels of an aggregate length of 22,000 feet which had to be excavated and 7,000 feet of 48-inch wooden pipe connects the tunnels, transmitting a continuous stream for seven miles down the canyon to the power house at its mouth; the total fall is about 400 feet.

Portland, Me.—The Sebago Transmission Company has been organized for the purpose of supplying electricity for heating, lighting and power purposes. The capital stock is \$50,000, of which nothing is paid in. Among the shareholders are Hon. Charles F. Libby, Portland; George W. Brown, Deering, and Harry L. Jones, Medford, Mass.

COMPANY MATTERS.

Detroit, Mich.—The plant of the Peninsular Electric Light Company was sold here last week by Court Commissioner Hurst, under foreclosure proceedings, for \$120,000. Geo. Peck, David Whitney, Jr., and Hoyt Post being the purchasers. The Peninsular Company was organized in 1891, and purchased the plant of the Brush Company for \$600,000.

Indianapolis, Ind.—C. F. Smith, president of the Indiana Bicycle Company, is negotiating for the purchase of a controlling interest in the American Electric Carriage Company of Chicago, and if the deal is completed will remove the factory to Indianapolis. The American Electric Carriage Company owns the patents for an electrically operated horseless vehicle, and Mr. Smith and other Indianapolis men will, it is said, invest about \$200,000 in the manufacture of the carriage.

Jersey City.—The first meeting of the North Jersey Street Railway Co. since it absorbed the Consolidated Traction Company was held here on the 6th inst. These directors were elected: John F. Dryden, L. D. Ward, Peter Hauck, J. F. Kehoe, James E. Shanley, David Young, Abram Q. Garretson, George F. Perkins, Edw. F. C. Young, A. J. Cassatt, T. Dolan, P. A. B. Widener, William L. Elkins and John D. Crimmins. The officers were elected next day as follows: President, Edward C. Young; vice-president, David Young; auditor, E. H. Hibbs; treasurer, E. N. Hill; secretary, Wilbur S. Johnson; general superintendent, Frank Ellmaker. E. F. Hebbard will have charge of the Essex County lines, H. W. Fuller of those in Hudson County and G. F. Chapman in Union County.

Newport, R. I.—Notice is being published in the local papers of the pendency of the petition of the Middletown and Portsmouth Street Railway Company and others, before the General Assembly of the State of Rhode Island at its present session, for the passage of a bill, entitled, "An act to consolidate the Middletown & Portsmouth Street Railway Company and the Fall River & Stone Bridge Electric Railway Company and confirming the consolidation already existing."

ELECTRICIANS IN THE WAR.

J. J. O'Rourke, an expert electrician employed by the Government in the work of placing mines in the St. John's river, Fla., was accidentally killed by a torpedo explosion in the mining-room at Jacksonville on the 10th inst. His assistant, named Houston, was also killed, and Lieut. William W. Harris, engineer officer in charge of the work, was severely injured by pieces of the torpedo striking him on the back and head. O'Rourke unaccountably connected the battery wire with a firing plug instead of a testing plug.

The cruiser Yankee, manned by New York naval reserves, and whose executive officer is Lieut. S. Dana Greene of the General Electric Company, is reported to have distinguished herself at Santiago and Caimanera in the recent bombardment of the forts that guard the entrances to those harbors. At Santiago, the Yankee ventured closer to the Spanish stronghold than any other vessel of the fleet, and her guns kept up such a rapid fire on the lower batteries that they were soon silenced. At Caimanera she and the Marblehead are said to have pounded the enemy's works into unrecognizable masses of ruins and caused a Spanish gunboat to take to her heels.

PERSONAL AND MISCELLANEA.

The special American commission to the Paris Exposition has arranged for a display of American electrical machinery to the value of \$1,000,000.

Edward L. Chapman, manager of the Electric Light Company at Grand Junction, Col., died in that city on the 7th inst., of appendicitis. The body was shipped to Cincinnati for burial.

Superintendent Nelson of the Milwaukee, Racine & Kenosha Electric Street Railway was recently presented with a handsome gold watch by the employees of the

road at Racine. Mr. Nelson had resigned his position and as soon as this was known, the men determined that he should take with him on retiring some testimonial of their esteem and respect.

Bernard Moebius, the scientist, died on board the steamship Kaiser Wilhelm der Grosse on her last outward passage. Mr. Moebius was credited with being the first to extract economically precious metals from base ores by means of electricity. He was also the author of several text books on metallurgy and electricity. He was a native of Hartha, Saxony, and was born forty-six years ago.

The Tonawanda "News" states that Philip Perow of Tonawanda, N. Y., has effected a patent for a canal boat towing trolley which is considered by those who have examined the model at the canal collector's office in Buffalo superior to any device heretofore proposed for the purpose. An experimental line will be erected on one of the State canals for a practical test of the invention, if permission can be obtained from Superintendent Aldrich.

C. E. Mears of Silver City, Ia., has on exhibition at the Omaha Exposition a curiosity in the way of the smallest horizontal steam engine in the world. The construction of every part is in full accord with mechanical rules, and the engine may be operated either by steam or air. It has been run with 10 drops of water for some time. There are 118 pieces in the engine, every one of which has been made by Mr. Mears himself. The cylinder of this tiny engine is $\frac{3}{8}$ of an inch long and the diameter of the flywheel is $\frac{3}{8}$ of an inch.

John J. Shipherd, whose death from paralysis of the heart occurred at Cleveland, O., on the 1st inst., was one of the most prominent figures in business and street railway circles in Ohio, and up to a few months ago one of the most respected, but his last days were embittered by certain charges made against him which impugned his honesty and fixed upon him the stigma of embezzlement. At the time of his death he was out on bail to answer this charge. He was born in Oberlin in 1840, and was the son of the founder of Oberlin College. Mr. Shipherd went to Cleveland in 1872 and resided there up to the day of his death with the exception of a short time passed in Indiana. Several years ago he formed a partnership with Charles H. Potter, under the firm name of C. H. Potter & Co., in the banking and investment business. Mr. Potter's connection with the firm has for some time been purely nominal. Later, Mr. Shipherd invested in a number of enterprises, among them street railway ventures in Fort Wayne, Ind., Cincinnati and elsewhere. He was also connected with the old Cleveland Cable Railway Company before its merging into the Cleveland City Railway Company. Mr. Shipherd within the last two or three years became involved in business difficulties and lost considerable money. At one time, several years ago, it was thought that he was moderately rich. His business troubles are supposed by many to have contributed to the disease which caused his death. His wife and two daughters survive him.

COMMERCIAL PARAGRAPHS.

There can be no more convincing commentary upon the wide range of applications of compressed-air power than the sales report of the Clayton Air Compressor Works, Havemeyer Building, New York, for the months of February, March and April. In all, nineteen air compressors were sold for operating pneumatic stone tools, chipping and calking tools, air hoists, etc.; nine air compressors for moving and elevating acid and chemical solutions; four air-lift pumping plants were installed and placed in operation; three air compressors were furnished to rubber works for removing hose from mandrels, testing hose and inflating tires; one compressor was supplied for the pneumatic transmission of messages; two for oil burning plants; three for racking off beer in breweries; one for spraying brick in the process of manufacture, and six for unusual applications of compressed air power. In addition to this number of air compressors furnished for domestic use, four were exported to Europe for operating pneumatic shop plants. Among the orders of especial interest included in the above summary may be mentioned the plant installed at the Navy Yard, Brooklyn, for supplying pneumatic drills, paint machines and hammers, and one furnished to the Yarrow Ship Yard, London, for operating pneumatic tools. Another installation of interest is the compressor at the Dunn Building, New York, which supplies compressed air-dusting nozzles for cleaning the iron grill work of the elevator shafts. Among the orders now in hand is a large compressor for the Bath Iron Works, Bath, Me., to operate pneumatic tools.

The new catalogue of the International Arc Lamp Company, Houston and Mercer streets, New York, contains handsome photo-engravings of a number of their new designs in arc lamps and lamp fixtures. Their lamps are all made from designs by Mr. MacIntire of the firm, who has achieved distinction through his productions in this line which for graceful forms and elegant proportions cannot well be surpassed. For interior illumination—parlors, libraries, drawing-rooms, dining rooms, boudoirs, etc.—the lamps of the company are especially to be commended, as many of the objectionable features existing in arc lamps have been eliminated. The catalogue is neatly printed and the engravings are real works of art.

INCORPORATIONS.

The Paducah Railway & Light Company, Paducah, Ky. Capital stock, \$200,000. Incorporators: George O. Thompson, S. J. Flouruey, George C. Walton and W. F. Paxton.

The Keene Electric Railway Company, Keene, N. H. Incorporators: F. H. Whitcomb, K. F. Lane, C. H. Hersey, C. J. Woodward, Edward Gastine, F. C. Faulkner, Daniel R. Cole and others.

The Maranacook Electric Light & Power Company, Maranacook, Me. Capital stock, \$10,000. President, Frank E. Dion; treasurer, John A. Hamblin.

The Deering Electric Light Company, Deering, Me.—to furnish electric light for the cities of Westbrook and Deering and towns of Gorham, Cape Elizabeth and South Portland. Capital stock, \$25,000, with nothing paid in. President, Elmer E. Fernald, Portland, Me.; treasurer, William L. Watson.

The Munson Company, Laporte, Ind.—to manufacture electrical appliances. Capital stock, \$100,000. Directors: William R. Everett, John H. Munson, William A. Roberts, Peter J. Heldt and Leroy A. Stringham.

Articles of association, incorporation, amalgamation and consolidation of the Pasadena & Pacific Railway Company of Arizona, the Pasadena & Pacific Railway Company of California, the Los Angeles & Pacific Railway Company of California and the Los Angeles Pacific Railway Company, consolidated, were filed on the 2d inst. with the county clerk at Los Angeles. The new concern is to be known as the Los Angeles Pacific Railroad Company. The estimated length of the road and its branches is 10 miles. The directors of the company are J. Ross Clark, M. H. Sherman, E. P. Clark, W. D. Larrabee, John D. Pope, M. E. Hammond and A. I. Smith. The capital stock of the corporation is \$1,000,000. E. P. Clark is president and A. I. Smith secretary.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 7, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

605,211. Trolley-Switch. Jacob H. Vanasselt, Seattle, Wash. Filed Oct. 2, 1897.

605,251. Trolley-Wire Hanger. George E. Johnson, Los Angeles, Cal. Filed Aug. 19, 1896. Renewed July 22, 1897.

605,261. Third Rail for Electric Railways. Sidney H. Short, Cleveland, O. Filed Nov. 5, 1897.

605,817. Electric-Railway System. William Lawrence, New York City, assignor to the Universal Surface Electric Railway Company of West Virginia. Filed Dec. 1, 1897.

605,826. Trolley Connection for Electric Cars. John G. McLaughlin, Brooklyn, N. Y., assignor of one-half to Robert W. Gleason, same place. Filed Dec. 28, 1897.

605,284. Car-Fender. George C. Hutchinson, St. Louis, Mo., assignor, by mesne assignments, of one-half to J. Reed Elliott, same place. Filed Oct. 7, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

605,228. Electric-Arc Lamp. William Hochhausen, Brooklyn, N. Y. Filed Jan. 22, 1897.

605,279. Safety-Lock for Incandescent Lamps. Ernst Falter and Hermann Herbstritt, San Francisco, Cal. Filed Sept. 17, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

605,667. Electric Switch. Charles C. Badeau, Schenectady, N. Y. Filed Sept. 17, 1897.

605,090. Electrical Apparatus for Charging Furnaces. Joseph P. Eck, Muncie, Ind. Filed Aug. 12, 1897.

605,154. Instrument-Winding Device. Henry H. Watt, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 14, 1896.

605,114. Electric Transformer. John J. Bellman and Charles T. Rittenhouse, New York City. Filed June 29, 1897.

605,197. Electrical Valve-Controlling Device. Arthur E. Colgate, New York City, assignor to George J. Shoeffel, Brooklyn, N. Y. Filed May 28, 1896. Renewed April 1, 1898.

605,304. Controller. Thorsten von Zweigbergk, Cleveland, O., assignor to the Walker Company, same place. Filed Feb. 23, 1898.

605,309. Electric Selector System. Thomas O. Drake, Malta, O. Filed Feb. 26, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

605,097. Telephone System. Edwin W. Ham, Worcester, Mass. Filed April 22, 1897.

605,294. Telephone-Holder. Jehiel T. Moore, Minneapolis, Minn., assignor of one-half to Harry L. Jenkins, same place. Filed Aug. 24, 1897.

605,341. Telephone System. Robert T. Reid and James McDonnell, Tacoma, Wash., assignors of one-half to Frank C. Cardin and John T. Bibb, same place. Filed Sept. 25, 1897.

605,345. Call-Box System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash., assignors to themselves and Frank B. Taylor, same place. Filed June 22, 1897.

SIGNALS AND SIGNALING APPARATUS.

605,358. Signaling Device. Frank B. Taylor, Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Filed July 23, 1897.

605,359. Railway Signaling and Switching Apparatus. John D. Taylor, Chillicothe, O. Filed March 24, 1897.

MISCELLANEOUS.

605,109. Insulator. Fred M. Locke, Victor, N. Y. Filed April 23, 1898.

605,174. Induction-Coil. Adrian L. Bogart, Jamaica, N. Y., assignor to William B. M. Jordan, New York City. Filed April 22, 1897.

605,231. Means for Raising Sunken Vessels. Laurent Magignon, La Garenne Colombe, France. Filed Nov. 80, 1897.

605,256. Insulator. Ralph D. Mershon, Colorado Springs, Col. Filed Feb. 14, 1898.

605,840. Process of Producing Aluminum Sulphide and Reducing Same to Metallic State. Henry S. Blackmore, Mount Vernon, N. Y., assignor to the Pure Aluminum & Chemical Company of West Virginia. Filed July 22, 1896. Renewed April 21, 1898.

605,424. Connector for Storage Battery Plates. Gilbert Hart, Detroit, Mich. Filed Jan. 18, 1898.

TELEPHONE AND TELEGRAPH.

The Western Union Telegraph Company has completed its line from Seattle, Wash., to Victoria, B. C.

The Minnesota Central Telephone Company has given notice of acceptance of the ordinance passed by the board of aldermen of St. Paul and has filed a bond for \$15,000.

There are indications at Atlantic, Ia., that there will be a rate war between the Iowa Union Telephone Company and the Atlantic, Mt. Etna & Corning Telephone Company.

The E. H. Martin Telephone Company of Webster City, Ia., is erecting a full metallic circuit from Boone to Des Moines which will give the company a direct inlet to the State capital.

The telegraph stations from Hong Kong to London are Saigon, Penang Island, Madras, Bombay, Aden, Suez, Alexandria, Malta, Gibraltar, Carcavellos, near Lisbon, and thence by ocean cable to England.

The New State Telephone Company is about to wire Jackson, Mich., for service, after which Chelsea, Dexter, Scio and Delhi will be quickly connected. The company is also extending its lines from Ann Arbor to Whitmore, Zuke, Portage and Base Lakes.

The lines of the Dixie Telephone Company have been completed to McMinnville, Tenn., and connected with the switchboard of the local exchange. This puts McMinnville in direct connection with Irving College, Viola, Beersheba, Monteagle, Altamont, Tracy City and other points.

The Interstate Telephone Company has been granted a franchise to erect an exchange in Raleigh, N. C., and operate its system in that city. The company is now building a line between Wilmington and Winston, and expects before a great while to connect Raleigh with the different towns along the line.

The ordinance granting a franchise to the Lackawanna Telephone Company has passed the second reading in the Scranton council and is likely to be adopted as the business people are generally favorable to the new company, which promises good service at much lower rates than those of the Bell company.

The Citizens' Telephone Company of New York has made application to the Hackensack Improvement Commission for permission to erect and operate an exchange in Hackensack, N. J. The company agrees to give commercial telephone service for \$2 a month and private service for \$1.50.

E. W. Coleman, in behalf of himself and associates, has addressed a letter to the mayor and council of Columbus, Ga., in which he requests permission to erect a telephone exchange in that city. He promises to install an underground system, long distance telephones and complete metallic circuit. The draft of an ordinance accompanying the letter was referred to the committee on ordinances.

A dispatch from Niles, Mich., states that the Gilliland Telephone Company had announced the suspension of its service in Niles. The death of the Gilliland system was due, it is stated, to the fierce fight with the Bell Telephone Company, which, in order to drive the weaker system out of existence, furnished service practically free of charge. It is now predicted that the Bell company will advance its rates.

The War Tax bill as agreed to by the Senate and House places a tax of 1 cent on all telephone messages for which a charge of 15 cents or more is made. Telegrams are taxed 1 cent each, and the companies incur a penalty of \$50 for failure to affix a stamp on each telegraph message transmitted, excepting only official dispatches of telegraph or railroad companies sent over their own wires, and official business of the Government. The President has signed the bill.

New Companies Incorporated.

The Winston Telephone Company Princeton, Mo. Capital stock, \$1,000. Incorporators: H. G. Orton, J. B. Hyde, O. P. Rogers and others.

The Bushnell Telephone Company, Chicago. Capital stock, \$5,000. Incorporators: Joel Lightner, E. E. Johnson and H. A. Cleveaud.

The Missouri & Iowa Telephone Company, Princeton, Mo. Capital stock, \$25,000. Incorporators: J. S. Rogers, H. G. Orton, E. M. Hyde and others.

The Montour & Columbia Telephone Company, Danville, Pa. Capital stock, \$25,000. Directors: James H. McDermitt, C. M. Clement, Sunbury; R. E. Polk, F. C. Angle, E. Carman, O. P. Hancock, Danville; H. R. Murty and J. P. Helfenstein, Shamokin; W. M. Vastine, Mt. Carmel.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.						Authoriz'd	Issued.			
Albany, N. Y.—June 13:							Hartford Conn.—June 13:						
Albany Ry. Co.....	100	2,000,000	\$1,750,000	1 1/4 % Q., Feb. '98.	85	90	Hartford Street Ry. Co.....	100	\$4,000,000	\$200,000	3 % S., Jan., '98.	140	--
Troy City Railway Co.....	100	2,000,000	2,000,000	1 % Q., Dec. 10, '97.	65	65 1/2	Hartford & West Hartford RR.....	100	1,000,000	247,000	.....	--	--
Traction Co. (Saratoga).....	100	50,000	50,000	.....	--	--	Holyoke Mass.—June 13:						
Allentown, Pa.—June 13:							Holyoke Street Ry. Co.....						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	.....	--	15	100	400,000	400,000	8 1/2 % A., Jan., '98.	230	236	
Bridgeport, Conn.—June 13:							Hoboken, N. J.—June 13:						
Bridgeport Traction Co.....	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	North Hudson Co. (N. J.) Ry. Co....	25	1,250,000	1,000,000	8 %, 1832.	70	--
Baltimore, Md.—June 13:							Indianapolis, Ind.—June 13						
Baltimore City Passenger Ry. Co....	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72	**Citizens' Passenger Ry.....	...	5,000,000	5,000,000	.....	24	25
Baltimore Consolidated Ry. Co....	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23 1/2	23 1/2	Lancaster, Pa.—June 13:						
Central Ry. Co. of Baltimore City..	50	800,000	800,000	5 % A. Dec., 1897.	80	82 1/2	Pennsylvania Traction Co.....	100	10,000,000	9,900,000	.....	--	--
Boston, Mass.—June 13:							Lancaster & Col. Electric Ry.....						
New England Street Ry.....	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	11	--	West End Street Railway.....	...	...	.....	--	--
North Shore Traction Co.....com.	100	4,000,000	4,000,000	.....	15	15	Louisville, Ky.—June 13:						
North Shore Traction Co.....pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	74	76	Louisville Ry.....com.	100	4,000,000	3,500,000	1 1/2 % S., Oct., '97.	84	39
West End Street Ry. Co.....com.	50	10,000,000	9,085,000	1 % S., Oct., '97.	83	84	Louisville Ry.....	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	96	100
West End Street Ry. Co.....8 % pfd.	50	6,400,000	6,400,000	1 % S., Oct. 1, '97.	102	104	Minneapolis, Minn.—June 13:						
Boston Elevated R. R.....	100	10,000,000	10,000,000	.....	64	65	Twin City Rapid Transit.....com.	100	17,000,000	15,010,000	.....	14	20
Brooklyn N. Y.—June 13:							Twin City Rapid Transit.....7 % pfd.						
Brooklyn City & Newtown Ry.....	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	195	--	...	8,000,000	1,714,200	1 1/2 % S., Jan., '98.	--	100	
Brooklyn Rap. Transit Co., tr. certf..	100	20,000,000	20,000,000	.....	51 1/2	52	Montreal, Canada.—June 13						
Brooklyn Heights Railroad.....	100	200,000	200,000	.....	--	--	Montreal Street Ry. Co.....	50	4,000,000	4,000,000	8 % S., M. & N.	257	257 1/2
*dBrooklyn City RR.....guar.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	210 1/2	--	Toronto Street Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	98	98 1/2
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	.....	--	--	Memphis, Tenn.—June 13:						
Coney Island & Brooklyn RR.....	100	1,000,000	1,000,000	1 1/2 % Oct. 1, '97.	195	205	Memphis Street Railway Co.....	100	500,000	500,000	.....	15	--
Kings County Elevated.....	100	4,750,000	4,750,000	.....	46	48	New Haven, Conn.—June 13:						
Kings County Traction Co.....	100	4,500,000	4,500,000	1 % July 28, '97	46	48	Fair Haven & Westville RR.....	25	1,500,000	900,000	1 % S., Sept. '97.	60	--
Nassau Electric Railroad.....	50	2,000,000	2,000,000	.....	74	80	New Haven Street Railway Co.....	100	1,250,000	1,000,000	2 1/2 % A., July '96.	60	80
Atlantic Avenue Railroad.....	50	2,000,000	2,000,000	.....	74	80	New Haven & Centerville.....	100	700,000	300,000	.....	--	--
Brooklyn, B. & W. E. Railroad...	100	1,000,000	1,000,000	.....	74	80	Winchester Avenue RR.....	25	1,000,000	600,000	.....	40	42
Buffalo, N. Y.—June 13:							New Orleans, La.—June 13:						
Buffalo & Niagara Falls Elec. Ry....	100	1,250,000	1,250,000	.....	58	60	Canal & Claiborne RR. Co.....	40	240,000	240,000	1 % S., Jan., '98.	140	160
*Buffalo Railway Co.....	100	6,000,000	5,370,500	1 % Q., Dec., '97.	82	84	New Orleans & Carrollton RR.....	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	123 1/2	126
Columbus O.—June 13:							New Orleans Traction Co.....com.						
Columbus Street Railroad.....	100	8,000,000	8,000,000	1 % Q., Feb., '93.	48	50	100	5,000,000	5,000,000	.....	1	3	
Columbus Centra. Street Railroad...	100	1,500,000	1,500,000	.....	--	--	New Orleans Traction Co.....pfd.	100	2,500,000	2,500,000	.....	7	10
Charleston, S. C.—June 13:							Crescent City RR.....guar.						
Charleston City Ry. Co.....	50	100,000	100,000	3 % S., Jan., '97.	--	--	100	2,000,000	2,000,000	3 % S., Jan., '98.	--	30	
Enterprise City RR. Co.....	25	1,000,000	250,000	.....	--	--	New Or. City & Lake RR.....guar.	100	2,000,000	2,000,000	1 % S., Jan., '98.	81	88
Chicago, Ill.—June 13:							Orleans Railroad.....						
Chicago City Ry. Co.....	100	12,000,000	12,000,000	3 % Q., Dec. 31, '97.	269	270	50	500,000	185,000	1 1/2 % S., June, '94.	16	17	
Chicago & South Side R. T. RR.....	100	10,323,800	10,323,800	.....	--	--	St. Charles Street Railway.....	50	1,000,000	1,000,000	1 1/2 % S., Jan., '98.	53 1/2	64 1/2
Lake Street Elevated RR.....	100	10,000,000	10,000,000	.....	13	13 1/2	New York—June 13:						
Metropolitan West Side Elev. Ry....	100	15,000,000	15,000,000	.....	3 1/2	3 1/2	Central Crosstown RR.....	100	600,000	600,000	2 1/2 % Q., July, '97.	210	--
Met. West Side El. const. stik.....	100	15,000,000	2,500,000	.....	--	--	*Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
North Chicago Street RR.....	100	10,000,000	6,600,000	3 % Q., Jan., '98.	199 1/2	200	Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	175	195
North Chicago City RR.....	100	500,000	219,900	.....	--	--	*Metropolitan Street Ry. Co.....	100	30,000,000	30,000,000	1 1/2 % Q., Jan., '98.	16 1/2	16 1/2
South Chicago City Railway.....	100	2,000,000	1,603,200	.....	--	--	*Bleecker St. & Fulton Ry. Ry. guar.	100	900,000	900,000	3 % A., July, '97.	32	33 1/2
West Chicago St. RR. Co.....	100	20,000,000	13,189,000	1 1/2 % Q., Feb. 93.	93 1/2	91 1/2	*Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	2	2
Chicago West Div. Ry.....guar.	100	1,250,000	624,900	35 % S.	--	--	*Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 1/2 % Q., Jan., '98.	180	185
Chicago Passenger Ry.....guar.	100	2,000,000	2,000,000	5 % S.	--	--	*Eighth Avenue RR.....	100	1,000,000	1,000,000	.....	329	325
Cincinnati, Ohio.—June 13:							42d St. & Grand St. Ferry RR. guar.						
Cincinnati Inc. Plane Ry.....com.	50	1,000,000	575,000	.....	20	20	100	750,000	748,000	4 1/2 % Q., Feb., '98.	530	561	
Cincinnati Inc. Plane Ry.....pfd.	50	150,000	150,000	2 1/2 % S., Feb., '98.	--	75	*Ninth Avenue RR.....	100	800,000	800,000	.....	170	180
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	.....	23	25	*Sixth Avenue RR.....	100	2,000,000	2,000,000	.....	200	210
Cincinnati Street Ry. Co.....	50	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	113	*Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 1/2 % Q., Feb., '98.	410	--
Mt. Adams & Eden Park Inc. Ry....	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.	--	--	Second Avenue RR.....	100	2,500,000	1,862,000	2 % Q., Jan., '98.	170	173
Cleveland, Ohio.—June 13:							Third Avenue RR.....						
Akron, Bed. & Cleve. Elec. Ry.....	100	1,000,000	1,000,000	1/4 % Jan., '98.	39	40	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	180	
Cleveland City Ry.....	100	8,000,000	7,600,000	1/4 % S., Oct., '97.	55	60	*42d St., Manhaty'le & St. Nich. Av	100	2,500,000	2,500,000	.....	87	80
Cleveland Electric Ry.....	100	12,000,000	12,000,000	1/4 % Q., Oct., '97.	50	53	*Union (Huck)berry Ry.....	100	2,000,000	2,000,000	.....	175	200
Detroit, Mich.—June 13:							Newark N. J.—June 13:						
Detroit Citizens' Street Ry.....	100	2,000,000	1,250,000	.....	100 1/2	--	Consolidated Traction Co. of N. J...	100	15,000,000	15,000,000	.....	47	48
Ft. Wayne & Belle Isle Ry.....	100	400,000	400,000	5 % July, '96.	175	--	Newark Passenger Ry.....	100	6,000,000	6,000,000	.....	--	--
Rapid Railway Co.....	100	250,000	250,000	.....	--	100	*Rapid Transit Street Ry.....	100	504,000	504,000	1 1/2 % A.	180	190
Detroit Electric Railway.....	100	1,000,000	1,000,000	.....	--	--	Pittsburg, Pa.—June 13:						
Wyandotte & Detroit River Ry.....	100	250,000	200,000	.....	100	110	Allegheny Traction Co.....	50	500,000	500,000	.....	46	--
Dayton O.—June 13:							Consolidated Traction Co.....com.						
City Railway Co.....com.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102	50	15,000,000	15,000,000	2 % S., Jan., '98.	15	15 1/2	
City Railway Co.....pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98.	140	145	Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000	3 % S., May, '97.	49 1/2	49 1/2
People's Street Railway.....	100	1,100,000	1,100,000	.....	100	--	*Central Traction Co.....	50	1,500,000	1,500,000	.....	--	--
							*Citizens' Traction Co.....	50	8,000,000	13,000,000	6 % A.	--	--
							*Duquesne Traction Co.....	50	8,000,000	13,000,000	6 % A.	--	--
							*Pittsburg Traction Co.....	50	2,500,000	1,900,000	3 % S., Aug., '95.	--	--
							*Federal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000	2 % S., Jan., '98.	237 1/2	241 1/2
							Pgh., Allegheny & Man. Trac. Co....	50	8,000,000	12,994,839	2 % S., Aug., '95.	--	--
							*Pittsburg & Birmingham Trac. Ry..	25	8,000,000	8,000,000	1 1/2 % S., Jan., '96.	18	18 1/2
							Pittsburg & West End Ry.....	50	1,500,000	1,500,000	5 % A., June 30, '97.	--	--
							Second Avenue Traction Co.....com.	50	4,000,000	14,000,000	.....	--	--
							Suburban Rapid Transit Co.....	50	800,000	200,000	.....	--	--

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10% on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; \$250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 85% per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5% on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.

a Leased to New Orleans Traction Company at 6% on stock.

b Leased to New Orleans Traction Company at 8% on stock.

c Leased to Central Crosstown Railroad at 8% on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavyon Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8% on stock until Oct. 1, 1897; thereafter 9%.

h Leased

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COOS.

NAME.						Capital Stock.			Rate and Date of Last Div.		Bld.		Asked.		NAME.						Capital Stock.			Rate and Date of Last Div.		Bld.		Asked.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
NAME.						Par	Authorz'd	Issued.	Rate and Date of Last Div.		Bld.	Asked.	NAME.						Par	Authorz'd	Issued.	Rate and Date of Last Div.		Bld.	Asked.	NAME.						Par	Authorz'd	Issued.	Rate and Date of Last Div.		Bld.	Asked.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
New Bedford Mass.—June 13														Boston, Mass.—June 13:														New York.—June 13:														Miscellaneous.—June 13:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Union Street Railway Co.....														100	\$850,000	\$850,000	2 %	Feb. '98.	...	158	American Bell Telephone Co.....														100	50,000,000	28,650,000	4 %	Q. Jan., '98.	272 1/2	278	American Telegraph & Cable Co....														100	14,000,000	14,000,000	1 1/2 %	Q.	92 1/2	98 1/2	American Dist. Teleg. (Phila.).....														25	400,000	1 %	Q. Feb. '98.	14	...																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Northampton, Mass.—June 13														Northampton Street Ry.....														100	800,000	225,000	4 %	A., Jan., '98.	165	175	Erle Telegraph & Telephone Co.....														100	1 %	Q. Jan. '98.	69	70	Bell Teleph. Co. (of Canada.).....														100	8,168,000	8,168,000	2 %	S.	170 1/2	178	Chesapeake & Potomac Teleg. Co....														100	Chicago Telephone Co.....														100	Central Dist. Prtg. & Tel. Co. (Pgh.)														100	750,000	750,000	Empire & Bay States Telegraph Co....														100	2,000,000	2,000,000	1 %	Q.	68	76																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Omaha, Neb.—June 13:														Omaha Street Ry.....														100	5,000,000	5,000,000	25	...	Hudson River Telephone Co.....														100	2,000,000	2,000,000	1 %	Q.	70	75	Northwestern Telegraph Co. guar.														50	2,500,000	2,500,000	2 3/4 %	Q.	112	117	Providence (R. I.) Teleph. Co.....														50	Southern New Eng. Teleph. Co.....														100	8,000,000	Fort Wayne Electric Co.....														Edison Elec. Ill'g Co., New York..														100	10,000,000	7,938,000	125	180	Edison Elec. Ill'g Co., Brooklyn..														100	4,000,000	3,750,000	1 1/2 %	Oct., '97.	106 1/2	107 1/2	Edison Ore Milling Co.....														100	10	18	Edison Electric Storage Co.....														100	10,000,000	30,160,000	2 %	Q., Aug., 1898.	87 1/2	88	General Electric Co.....														100	10,000,000	4,252,000	3 1/2 %	S., July, '98.	90	95	General Electric Co.....														100	10,000,000	4,252,000	3 1/2 %	S., July, '98.	90	95	Interior Conduit & Insulation Co....														100	1,000,000	1,000,000	41	...	United Elec. Lt. & Pow. Co.....														Pittsburg, Pa.—June 13:														Philadelphia, Pa.—June 13:														Miscellaneous.—June 13:																																																																																																																																																																																																																																																																																																																																																																																		
Rochester, N. Y.—June 13:														Rochester Railway Co.....														100	5,000,000	5,000,000	16	18	Edison Elec. Ill'g Co., New York..														100	10,000,000	7,938,000	125	180	Edison Elec. Ill'g Co., Brooklyn..														100	4,000,000	3,750,000	1 1/2 %	Oct., '97.	106 1/2	107 1/2	Edison Ore Milling Co.....														100	10	18	Edison Electric Storage Co.....														100	10,000,000	30,160,000	2 %	Q., Aug., 1898.	87 1/2	88	General Electric Co.....														100	10,000,000	4,252,000	3 1/2 %	S., July, '98.	90	95	General Electric Co.....														100	10,000,000	4,252,000	3 1/2 %	S., July, '98.	90	95	Interior Conduit & Insulation Co....														100	1,000,000	1,000,000	41	...	United Elec. Lt. & Pow. Co.....														Allegheeny County Light Co.....														100	500,000	500,000	J. & J.	127	...	East End Electric Light Co.....														50	800,000	800,000	Q	...	10	...	Edison Electric Light Co.....														100	2,000,000	144 1/2	...	Electric Storage Battery Co.....														100	8,500,000	22	28	Electric Storage Battery Co.....														100	5,000,000	24 1/2	25	Penna. Ht. Lt. & Pow. Co.....														50	5,000,000	50c. p. sh., Oct. '97.	Penna. Ht. Lt. & Pow. Co.....														50	5,000,000	6 % Oct., '97.	Northern Elec. Light & Power Co....														100	6,500,000	550,000	\$3.2500 dis. Jan. 11 '97	139 1/2	14	Southern Elec. Light & Power Co....														10	187,500	187,500	10	...	Brush Electric Co.....														50	87 1/2	40	Bridgeport (Conn.) Elec. Lt. Co....														25	500,000	18	18	Missouri-Edison (St. Louis).....														18	18	Eddy Electric Mfg. Co.....														25	125	128	Hartford (Conn.) Elec. Light Co....														100	850,000	6	11	Hartford (Conn.) Lt. & Power Co....														25	175,000	165	...	New Haven (Conn.) Elec. Lt. Co....														100	100,000	83 1/2	85	Narragansett (Prov. R. I.) Elec. Co....														50	1,200,000	2 % Q., Oct., '98.	110	120	Rhode Island Elec. Protec. Co.....														100	155	156	Royal Elec. Co. (Montreal).....														...	1,000,000	2 % Q	136 1/2	135 1/2	Toronto (Canada) Elec. Light Co....														100	1,085,000	1,085,000	1 1/2 %	Q	100	100	Thomson-Houston Welding Co.....														100	3 % S. Dec. 1, '98.	...	110	Woonsocket (R. I.) Electric Co.....														100	100	...	Boston Mass.—June 13:														New York.—June 13:														Philadelphia, Pa.—June 13:														Allied Industries.													
Toronto Ry. Co.....														100	6,000,000	6,000,000	1 1/4 %	S.	98	98 1/2	American Electric Heating Co.....														50	10,000,000	Street Ry. & Ill'g Properties.....														100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '98	80	85	United Electric Securities Co.....														100	3 %	Feb., '98.	80	...	Consolidated Electric Storage Co....														18	20	Edison European.....														1	8	Safety Car Heating & Lighting Co....														100	90	98	Worthington Pump Co.....														100	5,500,000	5,500,000	28	28	Worthington Pump Co.....														100	2,000,000	2,000,000	7 %	87	90	Acetylene L. H. & P. Co.....														50	1,000,000	Electro Pneumatic Trans. Co.....														10	1,500,000	74 1/2	...	United Gas Improvement Co. scrip.														50	10,000,000	18	14	Welsbach Commercial Co.....														100	8,500,000	60	62	Welsbach Commercial Co.....														100	500,000	2 %	Q	45 1/2	46																																																																																																																																																																																																																																																																																																																																																																																																																												
Washington, D. C.—June 13:														Belt Ry. Co.....														50	500,000	500,000	Capital Traction Co.....														100	12,000,000	12,000,000	65c. per sh. Oct. '97.	72 1/2	73 1/2	Columbia Ry. Co.....														50	400,000	400,000	6 %	A.	75	78	Eckington & Soldiers' Home Ry.....														50	707,000	652,000	8	...	Georgetown & Tenallytown Ry.....														50	200,000	200,000	Metropolitan RR. Co.....														50	1,000,000	453,930	2 1/2 %	Q.	121	125	Worcester, Mass.—June 13:														*Worcester Traction Co.....														100	8,000,000	8,000,000	15	17	*Worcester Traction Co..... 6 % pfd.														100	2,000,000	2,000,000	3 %	S. Feb., '98.	92	94	Worcester & Suburban Street Ry...														100	550,000	542,500	4 1/2 %	1897.	84	...	Wilkesbarre, Pa.—June 13:														Wilkesbarre & Wyoming Val. Trac.														100	5,000,000	5,000,000	1 %	Jan., '97.	24	29																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidated. c Electric, People's and Philadelphia Traction companies. Fixed charges on all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Leased to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Leased to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Leased to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Leased to Union Traction Company.
 m Leased to Union Traction Company.
 n Leased to Union Traction Company.
 o Leased to Union Traction Company.
 p Leased to Union Traction Company.
 q Leased to Union Traction Company.
 r Leased to Union Traction Company.
 s Leased to Union Traction Company.
 t Leased to Union Traction Company.
 u Leased to Union Traction Company.
 v Leased to Union Traction Company.
 w Leased to Union Traction Company.
 x Leased to Union Traction Company.
 y Leased to Union Traction Company.
 z Leased to Union Traction Company.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—June 13:												
Fort Wayne Electric Co.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..
Ft. Wayne Elec Co. T. Sec. Series A.....	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..
General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q.	Aug., 1898.	87 1/2	88	.....	.....	.....	.....	..
General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2 % S.	July, '98.	90	95	.....	.....	.....	.....	..
T. H. Elec. Co. T. Secur., Series D.....	100	.....	.....	.....	.....	8 1/2	8 1/2	.....	.....	.....	.....	..
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	.....	23	24	.....	.....	.....	.....	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 1/4 % Q.	Feb., '98.	84	85	.....	.....	.....	.....	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	.....	.....	.....	.....	.....	.....	.....	..
New York.—June 13.												
Edison Elec. Ill'g Co., New York...	100	10,000,000	7,938,000	.....	.....	125	130	.....	.....	.....	.....	..
*Edison Elec. Ill'g Co., Brooklyn...	100	4,000,000	3,750,000	1 1/2 % Oct., '97.	.....	108 1/2	107 1/2	.....	.....	.....	.....	..
Edison Ore Milling Co.....	100	.....	.....	.....	.....	10	13	.....	.....	.....	.....	..
Edison Electric Storage Co.....	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..
General Electric Co.....com.	100	40,000,000	30,460,000	2 % Q.	Aug., 1898.	87 1/2	88	.....	.....	.....	.....	..
General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2 % S.	July, '98.	90	95	.....	.....	.....	.....	..
Interior Conduit & Insulation Co.....	100	1,000,000	1,000,000	.....	.....	41	.....	.....	.....	.....	.....	..
United Elec. Lt. & Pow. Co..... pfd	..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..
Pittsburg, Pa.—June 13:												
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	.....	127	.....	.....	.....	.....	.....	..
East End Electric Light Co.....	50	800,000	800,000	Q	.....	..	10	.....	.....	.....	.....	..
Philadelphia, Pa.—June 13:												
Edison Electric Light Co.....	100	2,000,000	.....	.....	.....	144 1/2	.....	.....	.....	.....	.....	..
*Electric Storage Battery Co.....com.	100	8,500,000	.....	.....	.....	21	28	.....	.....	.....	.....	..
*Electric Storage Battery Co..... pfd.	100	5,000,000	.....	.....	.....	24 1/2	26	.....	.....	.....	.....	..
*Penna. Ht. Lt. & Pow. Co.....com.	50	5,000,000	.....	.....	50c. p. sh., Oct. '97.	..	.....	.....	.....	.....	.....	..
*Penna. Ht. Lt. & Pow. Co..... pfd.	50	5,000,000	.....	.....	6 % Oct., '97.	.....	.....	.....	.....	.....	.....	..
Northern Elec. Light & Power Co.....	10	6 1/2-0-000	550,000	\$32500 dist.	Jan. 11 '97	139 1/2	14	.....	.....	.....	.....	..
Southern Elec. Light & Power Co.....	10	187,500	187,500	.....	.....	10	.....	.....	.....	.....	.....	..
Miscellaneous.—June 13:												
Bush Electric Co.....	50	.....	.....	.....	.....	87 1/2	40	.....	.....	.....	.....	..
Bridgeport (Conn.) Elec. Lt. Co.....	25	500,000	.....	.....	.....	13	18	.....	.....	.....	.....	..
Missouri-Edison (St. Louis).....com.	..	.....	.....	.....	.....	..	13	.....	.....	.....	.....	..
Eddy Electric Mfg. Co.....	25	.....	.....	.....	.....	125	128	.....	.....	.....	.....	..
Hartford (Conn.) Elec. Light Co.....	100	350,000	.....	.....	.....	6	11	.....	.....	.....	.....	..
Hartford (Conn.) Lt. & Power Co.....	25	175,000	.....	.....	.....	165	..	.....	.....	.....	.....	..
New Haven (Conn.) Elec. Lt. Co.....	100	100,000	.....	.....	.....	83 1/2	85	.....	.....	.....	.....	..
Narragansett (Prov. R. I.) Elec. Co.....	50	1,200,000	.....	.....	2 % Q., Oct., '96.	110	120	.....	.....	.....	.....	..
Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	.....	155	156	.....	.....	.....	.....	..
Royal Elec. Co. (Montreal).....	..	1,000,000	.....	.....	2 % Q.	136 1/2	139 1/2	.....	.....	.....	.....	..
Toronto (Canada) Elec. Light Co.....	100	1,085,000	1,085,000	1 1/4 % Q	.....	100	100	.....	.....	.....	.....	..
Thomson-Houston Welding Co.....	100	1,085,000	.....	.....	3 % S., Dec. 1, '96.	100	110	.....	.....	.....	.....	..
Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	.....	100	110	.....	.....	.....	.....	..

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.	NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.						Authorized.	Issued.				
Albany, N. Y.							New Orleans La.						
Date of Quotation—June 13, 1898.							Date of Quotation—June 13, 1898.						
The Albany Ry. 1st mtg. 5s.	.....	\$29,000	1905	J. & J.	.....	.....	Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111	.....	Crescent City RR. 1st mtg. 6s.	50,000	50,000	1899	M. & N.	101	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	.....	Crescent City RR. Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75½	77
Watervliet Turnpike & RR. 1st mtg. 6s.	350,000	350,000	1919	M. & N.	*117½	.....	New Orleans City RR. 1st mtg. 6s.	418,500	899,000	1903	J. & D.	108	111
Watervliet Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....	N. Orleans City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98¼	99¼
Troy City Railway Co. 1st mtg. 5s.	.....	.....	.....	.....	*105	105½	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	.....
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.							Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	9½	100
[St. Charles St. RR. Co. 1st mtg. 6s.							800,000	75,000	1906	J. & D.	104	.....
\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$990,000 outstanding.							New York.						
Date of Quotation—June 13, 1898.							Date of Quotation—June 13, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....	Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	106	.....
Baltimore Trac. Co. Ext'n. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	102½	103	Atlantic Av. (Brooklyn) Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	*105	109
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114½	115	B'way & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120½
Bal. Trac. Co. Coll. Trust 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101½	.....	B'way & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103½	.....	B'way & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	*110	112
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	.....	B'way Surface 1st mtg. 5s.	1,125,000	1,125,000	1924	.....	*114	116
Central Pass. Ry. Co. Cons. mtg. 5s.	604,000	580,000	1932	M. & N.	113	116	B'way Surface 2d mtg. 5s.	1,000,000	1,000,000	1905	.....	106	*107
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113½	114½	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....	Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	116
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119½	Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. \$151,000 in escrow to retire 1st mtg. bds.							Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	95	.....
Boston, Mass.							Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108
Date of Quotation—June 13, 1898.							Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
Lynn & Boston RR. 1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	101½	105	Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945	.....	9½	.....
West End Street Ry. Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	.....	Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	101	104
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....	Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	108	112
\$1,674,000 in escrow to retire outstanding bonds of absorbed companies.							Central Crosstown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	122
Charleston S. C.							Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	103	105
Date of Quotation—June 13, 1898.							D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	114	116
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....	Dry Dock, E. Bd'y & Bat'y R. scrip 5%.	1,100,000	1,100,000	1914	F. & A.	100	*103
Charleston City Ry. 1st mtg. 6s.	850,000	.....	.....	J. & J.	.....	.....	Eighth Ave. RR. Co. Cert. Indeb. 6%.	1,000,000	1,000,000	1914	F. & A.	108	.....
Controlled by Charleston St. Ry. Co.							42d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
Chicago Ill.							42d St., Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	93
Date of Quotation—June 13, 1898.							Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1933	M. & S.	117½	.....
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101½	102½	Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	113	.....
Chicago Passenger Ry. 1st mtg. 6s.	400,000	400,000	1905	F. & A.	103½	.....	Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110½
Chicago Passenger Ry. Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	.....	.....	Second Avenue Ry. Deb. 5s.	800,000	800,000	1909	J. & J.	106	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....	Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
Chicago & So. Side R. T. 4½s.	1,500,000	750,000	1907	J. & J.	104½	.....	South Ferry RR. Co. 1st mtg. g. 5s.	850,000	850,000	1919	.....	106	111
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1907	J. & J.	104½	.....	Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	120	121
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	63	70	Twenty-third Street Ry. 1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	45	48	Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	103	108
North Chicago St. RR. 1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105	Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	111	114
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	103	.....	Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	.....
North Chicago City Ry. 1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	.....	\$1,035,000 in escrow to retire gen. mtg. bonds.						
North Chicago City Ry. consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	.....	\$14,850,000 in escrow to retire maturing obligations.						
West Chicago St. RR. 1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103	104	\$552,000 in escrow to retire 1st and 2d mtg. bonds.						
West Chicago St. RR. Deben. 6s.	2,700,000	700,000	1911	J. & D.	100	100½	In treasury, \$80,000.						
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	90½	91½	Guar. by Union Ry. Co.						
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	.....	Toronto Canada.						
Redeemable at option on 60 da. notice.							Date of Quotation—June 13, 1898.						
Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.							Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	.....	.....
Subject to call after Oct. 1, 1899, at \$110 and interest.							Toronto St. Ry. 1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	.....	.....
Assumed by W. Chi. RR. Co., lessee.							\$35,000 per m. single track authorized \$600,000 in escrow to retire 6s due in 1901.						
Int. guar. by W. Chicago St. RR. Co.							Philadelphia.						
Cincinnati, O.							Date of Quotation—June 13, 1898.						
Date of Quotation—June 13, 1898.							Continental Pass. Ry. 1st mtg. 6s.	850,000	810,000	1909	J. & J.	.....	.....
Oln. New. & Cov. St. Ry. 1st Cons. mtg. g. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101	Empire Pass. Ry. 1st mtg. 7s.	200,000	200,000	1900	J. & J.	.....	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....	Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	.....	.....
Mt. Adams & Eden Pk In. 1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	.....	Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000	.....	1901	.....	.....	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	108½	.....	People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	.....	.....
So. Cov. & Oln. St. Ry. 1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	.....	People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	.....	.....
So. Cov. & Oln. St. Ry. 2d mtg. 6s.	400,000	400,000	1932	J. & J.	129½	.....	People's Pass. Ry. Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	.....	.....
Assumed by the Cincln. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.							People's Pass. Ry. Stk. tra. cert. g. 4s.	5,698,210	.....	1943	.....	101	102
Cleveland, O.							Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1910	J. & J.	.....	.....
Date of Quotation—June 13, 1898.							Philadelphia Trac. Co. Coll. tr. g. 4s.	1,800,000	1,018,000	1917	F. & A.	104	105
a Brooklyn Street RR. Co. 1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107	Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1903	A. & O.	.....	.....
Oln. New't & Cov. St. Ry. Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101	Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1911	A. & O.	.....	.....
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½	Union Traction Co. Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	.....	.....
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	100	103	West End Passenger Ry. 1st mtg. 7s.	.....	.....	1905	.....	.....	.....
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	101½	105	West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115½	.....
a East Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	101½	105	West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	114½	115
Pt. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	.....	1922	M. & N.	.....	.....	The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Lorain (O.) Street Ry. 1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	.....	Pittsburg, Pa.						
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	.....	.....	Date of Quotation—June 13, 1898.						
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a.							Birmingham, Knox & Allentown. 6s.	500,000	500,060	1931	M. & S.	88½	91
Interest guar. by Cons. St. Ry. Co.							Central Traction Co. 1st mtg. 5s.	875,000	875,000	1930	J. & J.	.....	.....
Detroit, Mich.							Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	.....	.....
Date of Quotation—June 13, 1898.							Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	109½	.....
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	96½	99	*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1913	J. & J.	.....	.....
Pt. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	377,000	1902	A. & O.	.....	.....	Fed'l St. & Pleasant Valley. Cons. 5s.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—June 13, 1898						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	97	100
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co. 1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	107
†Mound City RR. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
†People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co. 1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. 1st mtg. 6s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry. Income 5s.	800,000	800,000	.....	.....	60	64
†Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry. 1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$400,000 in escrow.						
††\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June, 1898.						
California St. Cable RR. 1st mtg. g. 5s.	1,001,000	900,000	1915	J. & J.	118	119
†Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St. Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	102	103
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
†Metropolitan Ry. Co. 1st mtg.	200,000	200,000	.....	.....	127	130
†Omni-bus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR. 1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	106
†Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—June 13, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	450,000	1920	J. & J.	45	100
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	114	115
Eckington & Soldiers' Home. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—June 13, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
†Citizens St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	79	80
†Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
†Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	103
†Crosst'n St. Ry. (Colu's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
†Denver City Cable Ry. 1st mtg. g. 5s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
†Denver Con. Tran'y Co. Cons. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
†Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
†No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
†No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
†Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
†Rochester (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	.....
†St. Paul City Ry. 1st mtg. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
†St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$47,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—June 13, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	1922	Quar.	156	.....
General Electric Co., gold coup. deb. 5s..	10,000,000	8,750,000	.....	.....	104	.....
Pittsburg, Pa.						
Date of Quotation—June 13, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 4s.	250,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Serp 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous.						
(June 13, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,812,000	1910	.....	109	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,146,000	1933	.....	118½	.....
Edison Elec. Ilig. Co. (Brooklyn) 1st mtg. 5s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 1st mtg. 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 1st mtg. 6s.	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1906	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q. ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 1st mtg. 6s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—June 13, 1898.						
American Bell Telephone Co. 1st mtg. 7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telephone Co. 1st mtg. 7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Tel. & Telg. Co. gen. mtg. 5s.	.....	.....	1911	J. & D.	108½	.....
Chesapeake & Potomac Telephone Co. 5s.	.....	.....	.....	.....	.....	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—June 13, 1898.						
American Electric Heating Co. 1st mtg. 5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 1st mtg. 5s.	.....	.....	.....	.....	25	100
*Barney & Smith Car Co. 1st mtg. 5s.	.....	.....	1942	J. & J.	95	.....
Carborundum Mfg. Co. 1st mtg. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 1st mtg. 5s.	15,000	.....	.....	.....	.....	.....
*Unlisted						
†Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 11.90@12.10c. casting, 11½c.

The stock of the Dayton (O.) Traction Company has been listed on the Philadelphia Stock Exchange.

War seems to have a good effect on American stocks good and bad. There has been a rise in the whole list since the opening of hostilities.

The Chicago City Railway Company has declared its regular quarterly dividend of 3 per cent., payable June 30. Books close June 15 and reopen June 21.

The United Traction & Electric Company of Jersey City has declared a dividend of 2 per cent., payable July 1. Books close June 21 and reopen July 2.

The \$5,000,000 four per cent. ten year debenture bonds of the American Bell Telephone Company have been awarded to Lee, Higginson & Co., Boston.

The Philadelphia "Stockholder" says: "Until autumn nothing definite will be done in the direction of readjusting the finances of the General Electric Company." Manana!

The directors of the Western Union Telegraph Company have declared the usual quarterly dividend of 1½ per cent., payable July 15. Books close June 20 and reopen July 1.

The Commercial Cable Company has declared its usual quarterly dividend of 1½ per cent. on the capital stock of the company, payable July 1. Transfer books close June 20 and reopen July 2.

According to official figures the gross receipts of the North Chicago Street Railway Company in May were \$2,448,670, an increase of \$11,011 over the same month last year and \$13,887 compared with April, 1896.

The Chicago Stock Exchange election last week resulted as follows: President, Alfred L. Baker; treasurer, John J. Mitchell; members of the governing committee: B. K. Cain and C. H. McGrath.

It is understood that a satisfactory arrangement has been reached by the Bridge Commissioner and the managers of the elevated roads by which the elevated cars will be run on Brooklyn Bridge.

A dispatch from Poughkeepsie, N. Y., states that Judge Shipman has just decided the foundation reversible trolley patent in favor of the Walker Company and against the General Electric Company, with costs against the latter company.

The stockholders of the Brooklyn Edison Electric Illuminating Company, at a meeting held in Brooklyn on the 2d inst., voted to authorize the board of directors to increase the capital stock of the company from \$4,000,000 to \$5,000,000.

The law requiring the street railway companies of St. Louis to make their returns for assessment and taxation to the State Board of Equalization instead of to the city assessor went into effect this year. The returns are made on June 1, each year.

The Chicago Edison Company reports for the fiscal year ended March 31, 1898: Gross earnings, \$1,661,843; operating expenses, \$985,338; net income for the year, \$676,504; charges against income, interest on bonds and debentures, \$226,680; dividends, \$398,072; balances, \$51,772.

The Massachusetts House by a vote of 119 to 90 passed the street railway bill providing that all dividends over 8 per cent. shall accrue to the State and levying a graded excise tax. The Boston Elevated is exempt for 25 years. The bill has passed the third reading in the Senate.

The Court of Appeals has decided in the "Bridge trolley case," in which William R. Heurt was appellant against John Shea and others respondents, that the New York & Brooklyn Bridge Company had a right to construct or lay loops for the use of electric trolley railways across the passageway for foot passengers at the New York terminus.

The city of Philadelphia has a plant in operation for the manufacture of crude electrozone for disinfecting purposes. The Electrozone Commercial Company proposes to erect similar plants in New York State in all cities needing pure water supply and purified sewage. On a capital of \$5,000,000 it is stated that the British Electrozone Company last year paid 25 per cent. in dividends.

Word has been received at Amesbury, Mass., from Concord, N. H., stating that the committee appointed by the New Hampshire Supreme Court had reported favorably on the petition of the Amesbury & Hampton Street Railway Company to lay its tracks within the New Hampshire State limits. The message stated that the New Hampshire Secretary of State would at once issue a charter to the company and the construction of the road would then be commenced.

One cause of the failure of Hooley, the great London promoter, as given by the "Financial Post" of that city, has a broad application. Says the "Post": "You may manipulate the shares of a company and get them quoted at a fictitious price upon the stock exchange, but if, as is the case with every one of Mr. Hooley's companies, the capital is in enormous excess of what it ought to be, you cannot pay respectable dividends—any way, for any length of time."

The plant of the Bloomington, Ill., City Railway Company was recently sold by order of the court and was purchased by a syndicate representing the second bondholders for \$202,500. On the 6th inst. some of the parties to the litigation headed by John T. Patterson, who has controlled the road for ten years, asked Judge Myers to set aside the sale. The application was made in the interest of the third mortgage bondholders, who claim their interests have not been protected, and that the road should have brought a larger price, and will do so if sold again.

The State Railroad Commissioners at Albany, N. Y., on the 8th inst. gave a hearing on an application of the Catskill Electric Railway for permission to increase its capital stock from \$30,000 to \$400,000. The company intends to extend its lines to Windham and Cairo and other villages in Greene and adjoining counties, instead of only operating in Catskill village as originally intended. The Commissioners reserved decision.

"Greater Buffalo," a magazine published in Buffalo, N. Y., advocates the establishment of cotton and other factories in that city and neighborhood on the ground that an abundant and cheap supply of electrical power from Niagara Falls would insure great economy in operation. It argues thus: "For example, 1,000 horse-power can be generated in the Eastern mill at the cost of \$25 per horse-power per year for ten hours a day. The cost of 24 hour power would therefore be \$60 per year and 1,000 horse-power would cost \$60,000 per year for continuous service. The cost of electric power on the Niagara frontier would be \$18 per horse-power per year, 24 hours per day. The loss by friction in the application of steam power by shaft and belting is 50 per cent. The loss in the application of electric current is 25 per cent. The saving effected in the use of electric power is therefore 25 per cent. of the power generated. The mill needing to generate 1,000 horse steam power would have to purchase only 750 electrical horse-power to attain the same results. 750 horse-power at \$18 per horse-power per year comes to \$13,500, which, compared with \$60,000, shows a saving of \$46,500 per year by the use of electric power. This sum represents a dividend of nearly 10 per cent. on a capital of half a million dollars."

The certificate of incorporation of the White Plains Lighting Company, formed for the manufacture and use of electricity for producing light, heat and power, and in lighting streets and public and private buildings, was filed in the county clerk's office, White Plains, N. Y., on the 10th inst. The amount of the capital stock is \$50,000, divided into 500 shares, and the duration of the company is fifty years. The directors are Winthrop G. Bushnell, New Haven, Conn.; Joseph L. Hall, Port Chester, N. Y., and John C. Bennett, Brooklyn, N. Y.

ELECTRICITY.

Vol. XIV.

NEW YORK, JUNE 22, 1898.

No. 24.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:	
UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	iv
Classified List of Advertisements,	viii
Editorial Notes,	369 370
The Northwestern Electrical Convention.	
The General Electric Stock Problem.	
Kite Telephoning.	
Under the Searchlight,	370
The New York Electrical Society,	370
Analysis of the Cost of the Generation and Distribution of a Unit of Electricity. By Calvin W. Rice,	371
Investment per Kilowatt.	
Distribution System.	
Plant Management.	
Load Factor.	
English Lighting Plant Statistics.	
Railway Plants—Cost of Operating, etc.	
Discussion.	
The Ohio Street Railway Association,	377
The Distribution of Electrical Energy in Paris. By J. Laffargue,	377
Midsummer Meeting of the Northwestern Electrical Association,	378
Legal Notes,	379
The News,	379
Lighting Plants—Street Railways—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Commercial Paragraphs,	380
Incorporations,	380
Electrical Patent Record,	380
Telephone and Telegraph,	380
Electrical Securities—Stocks, Bonds, Etc.,	381
Notes for Investors,	384

EDITORIAL NOTES.

The Northwestern Electrical Convention.

The midsummer meeting of the Northwestern Electrical Association, held on board the steamer North West en route from Chicago to Duluth, was unquestionably one of the most enjoyable as well as instructive gatherings that Association has ever held. The happy thought of holding this meeting in a floating convention hall on Lake Michigan proved an extremely popular one, there being considerably over 100 members and guests present. In spite of the fact that the start from Chicago was made under more less unpleasant conditions, owing to the inclement state of the weather, no inconvenience was experienced, and the enjoyment of the evening of the first day out, which was mostly given over to social intercourse, was in no way marred, the large number of ladies present materially adding to the pleasure of the gathering.

In spite of the many enjoyable attractions aboard, the scientific feature of the Convention was by no means lost sight of. A number of excellent papers on practical subjects were read and ably discussed. The unique feature of a question-box proved a success and was the means of eliciting much useful and instructive information on important subjects. A report of the proceedings of the Convention will be found elsewhere in this issue. At Minneapolis, after a dinner given the members of the Association and their guests at the Mercantile Club by President Morgan Brooks of the Electrical Engineering Company of that city, Mr. J. M. Hill was presented by the members of the party with a handsome scarf-pin as a token of their high appreciation of his efforts in making the trip so thoroughly enjoyable. The Midsummer Convention of the Northwestern Electrical Association will most assuredly be remembered by those who participated in it as an enjoyable and instructive outing.

* * *

The General Electric Stock Problem.

Messrs. Samuel Carr, Thomas L. Livermore and Edward F. Atkins, who were appointed a committee in January, 1896, by holders of more than one-half of the preferred stock of the General Electric Company, have recently issued a circular addressed to the holders of the preferred stock which, after referring to the financial condition of the General Electric Company as set forth in its last annual report, says: "To remove what directors regard as legal obstacles in the way of resuming dividend payments, it has been suggested to us that the nominal

value of the capital stock should, by vote of shareholders, be reduced so as not to exceed the value of the assets of the company, and to this end a reduction of 50 per cent. of the par value of the shares has been suggested, together with payment of the accumulated dividends on the preferred shares to date of reduction at rate of 7 per cent. on the present par value of \$100 per share.

"Eminent counsel advise the directors that as a legal result of this reduction the holders of preferred shares would be entitled to dividends out of future earnings of 7 per cent. on \$50 per share only, while holders of the common shares would be entitled to all the remaining earnings. This would, for the future, reduce the dividend on preferred shares one-half, while it would leave the common shareholders in a better position than their present one.

"The assets of the company amount to at least 72 per cent. of the par value of all the shares, and for this reason we have declined to recommend a reduction to any amount below \$72 per share. We have some encouragement to believe the common shareholders might assent to a reduction to \$80 per share. At an early day the proposition to reduce the par value of the shares to \$50 is to be submitted to a meeting of stockholders, and unless restrained by legal process it can, under New York laws, be carried by a vote of two-thirds. We propose, if encouraged by legal advice to be taken, to oppose this project at the meeting and if necessary in the courts."

It is but natural that the preferred stockholders' committee should object to the proposed plan of scaling down the preferred stock by one-half, and especially Mr. Samuel Carr, who represents the Ames estate which owns 7,961 shares of preferred stock in the General Electric Company. It is likewise natural that the preferred stockholders should want to get the reorganization price of the stock as high as possible. As the dividends in this class of stock are cumulative, and as they will ultimately have to be paid before any of the common shareholders receive any dividends, it would certainly seem good judgment on the part of the preferred stockholders to object to this scaling process and await developments. Were we a preferred stockholder we should strenuously object to having the par value of our stock reduced by one-half and possible future dividends reduced in proportion, for if no dividends can be earned the stock is practically worthless anyway, whereas if the company ever does get in a position to pay a regular dividend the preferred stockholders might just as well insist on being paid dividends on stock with a par value of \$100 as on stock that has a par value of but \$50, or, as has been suggested, \$72. Moreover, the preferred stock was presumably purchased in good faith, with the understanding that the dividends were to be cumulative, and it has been promised that as soon

as the earnings of the company justified it the payment of these dividends would be resumed. Next month these accumulated dividends will have aggregated 35 per cent., and it is certainly to the interest of the preferred stockholders that the dividends (so long as they cannot be paid) should go on accumulating at the rate of 7 per cent. a year rather than at the rate of $3\frac{1}{2}$ per cent., which is practically what this scaling down process means. As the report of the committee aptly says, the arrangement suggested would leave the common shareholders in a far better position than their present one by throwing the whole burden upon the preferred stockholders, which in our opinion is contrary to the intent and meaning of the word "preferred."

As the preferred stockholders have been waiting since 1893 for a dividend, it would certainly seem as though they might wait a little longer, and be paid possibly full dividends some time in the future, rather than jump at a settlement on a fifty cents on the dollar basis.

As we have frequently stated, a concern should not be capitalized for a greater amount than its yearly gross earnings, and in the case of the General Electric Company, therefore, its capitalization should not exceed \$12,524,938, and on a basis of say \$13,000,000 there would not be much left for the common stockholders after the preferred stockholders and the bondholders get their just dues. It will therefore be seen that the great and only General Electric Company is not in a comfortable condition. Fixing the value of either the common or preferred stock by action of the stockholders does not make an actual value by any means. It takes sufficient profitable business to pay dividends, and if the General Electric Company had all the electric light and power business it could not earn dividends on over \$20,000,000 capitalization. As it stands, that company does little more than half the business.

* * *

Kite Telephoning. Some recent experiments in England in which a kite was made to support a telephone wire connecting two ships has created considerable talk in United States naval circles as possibly affording a new and simple method of signaling either between ships at sea or between ships and a fort. The importance and value of kites in warfare was conclusively proven in a number of experiments made at Governor's Island in New York Harbor some time ago, when a camera was sent up and took an accurate photograph of the surrounding country.

The telephonic kite, however, is a new departure, and, as previously stated, was tried for the first time by the English naval authorities. The kite used in the experiment was of the ordinary kind, six feet long by three across at the broadest part, but in place of a tail the kite carried two wires. One of these was attached to a torpedo boat destroyer, while the end of the other was without difficulty dropped on the deck of H. M. S. Dauntless, where it was secured and made fast to a suitable telephone apparatus.

The end of the wire on the torpedo destroyer was also attached to a telephone, and as soon as both connections were made it was found that the two ships were in perfect communication. The experiment lasted four hours, during which time the kite remained suspended, secured by the two wires, and communication between the two vessels was uninterrupted.

The successful carrying out of this experiment and one recently made in this country should prove of value in more ways than one. It showed conclusively that it was possible to arrange a new system of signaling from one ship to another that would be far superior to any system of flag signaling now in use, as after telephonic kite connection between two ships had been made, messages could be transmitted by telephone far more rapidly than by any system of codes. Moreover if a telephone wire can be com-

neoted in this manner there would seem to be no reason why telegraphic communication cannot be made in a similar fashion. In such a case an operator on board the flagship, for instance, could carry on a conversation with his fellow operator aboard one of the fleet without difficulty. As a means of communication at night between two ships in hostile waters the kite telephone should prove especially valuable, as it would enable the two commanders to hold a conversation without having to have recourse to the Ardois system, which would necessarily reveal their exact location to the enemy. Difficulty would probably be experienced in getting a kite wire from one ship to another after dark, but were connections made during daylight the two ships could shift their position and be in communication all night without apprising the enemy of the fact.

The successful experiment recently made in England is only evidence of what electricians of the navy have held to be possible. It has been declared of late, especially since kites have been utilized so successfully for photographic purposes, that there was no reason why kite telephone communication should not be established between vessels not too far apart were the weather at all suitable. A practical experiment along this line was made a few days ago in this country by William A. Eddy which in the latter's opinion demonstrates that kites can be made use of for field telephoning in time of war.

Under the Searchlight.

Notes and Comments on Various Topics.

WITH reference to an item which appeared in our issue of June 15, entitled "Is This Another General Electric Scheme?" we are in receipt of the following communication:

Philadelphia June 16, 1898.

Editor ELECTRICITY.

DEAR SIR: In noticing the flotation of the General Electric Automobile Company of this city, in your current issue, under the caption "Is This Another General Electric Scheme?" you leave it to be inferred that your confidence in the new concern is not especially vigorous. Lest the enterprise suffer in your esteem because of its title, it is but proper that you be informed that it has no connection with the General Electric Company. It is a purely local enterprise, organized for the purpose of commercially developing the Hunter patents in their application to automobile vehicles. The people concerned are substantial business men. Yours truly,

DAILY PHILADELPHIA STOCKHOLDER.

J. H. MONTGOMERY, Asso. Editor.

* * *

THE Kansas City, Mo., *Journal* says that if the rate war continues between the Frisco Railroad and the electric line, which has already brought the cost of a ride between Joplin and Galena down to five cents, a free ticket with a coupon good for a drink at either end of the line needn't be looked upon as beyond the possibilities.

* * *

AN Austrian professor is said to have invented a new system of wireless telegraphy which does away with many of the defects in the Marconi system. The telegraphic signs are transmitted, so it is claimed, by means of electric light rays.

* * *

IN a certain church in Glasgow there has recently been installed a telephone connection between the pulpit and a pew in the back of the church, by means of which a lady, who has been unable owing to deafness to hear the minister, can now listen with ease to the discourse. The sound is conducted from the pulpit by means of two transmitters fitted on to ornamental hammered iron scroll-work brackets, in keeping with the other iron-work brackets of the church, and these are screwed on to the ledge of the pulpit on either side of the reading desk, and far enough apart not to hamper the movements of the officiating clergyman. The wires are led from the pulpit behind the wainscoting to the pew, where a battery switch is placed, so that the party using the

telephone can switch the current off when the minister is not speaking. We think that some arrangement might become popular in this country in the congregation of weak-voiced preachers, provided of course the switching apparatus works properly, thus enabling the party listening to occasionally cut off the discourse and take a nap.

* * *

THE manager of the Electrical Exposition in Philadelphia asked Mr. Edison to visit the show and give a short talk on some electrical subject, or if he found it inconvenient to do so, to send on a phonograph cylinder setting forth some of his latest ideas of electrical interest. Mr. Edison complied in his own way with the latter request, and in doing so, while omitting any reference to electricity, produced quite an electrical effect upon the management and the auditors by his contribution. It was as follows:

My dear Marks: You asked me to send you a phonographic cylinder for your lecture this evening and to say a few words to the audience. I do not think the audience would take any interest in dry scientific subjects, but perhaps they might be interested in a little story that a man sent me from a phonograph cylinder the other day from San Francisco.

In the year 1873 a man from Massachusetts came to California with a chronic liver complaint. He searched all over the coast for a mineral spring to cure the disease, and finally he found down in the San Joaquin Valley a spring the waters of which almost instantly cured him. He thereupon started a sanitarium, and people from all over the world came and were quickly cured.

Last year this man died, and so powerful had been the action of the waters that they had to take his liver out and kill it with a club. Yours truly,

EDISON.

* * *

MASSACHUSETTS is nothing if not patriotic. It was so during the Revolution and is so to-day. Its patriotism, however, occasionally assumes peculiar and original forms. We now hear of a certain town in the Bay State that has become so enthusiastic on the war question that the local electric railway company has been obliged to have built what might be termed a trolley car warship. This novel vehicle is supposed to resemble the cruiser "Brooklyn" (but why it was not patterned after the "Boston" is hard to say), and is said to be extremely well patronized.

* * *

A CHICAGO inventor is said to have succeeded in producing india-rubber from corn oil. The india-rubber so produced is said to be equal in quality to the genuine article. The only regrettable feature of the whole thing is that the process is still in an experimental stage. Should the rubber produced in this way, however, come up to what is expected, it would materially reduce the cost of many electrical instruments.

New York Electrical Society.

The following members of the New York Electrical Society who have changed their residence are requested to send their new address to the Secretary, 120 Liberty street, New York City: G. Arnold, A. C. Barrett, A. B. Bennett, Thos. Bennett, C. J. Bickley, Geo. Book, Jr., D. D. Book, B. F. Card, J. A. Cabot, Harry Cette, C. E. Chinook, J. S. Cobb, W. F. Collins, R. Crawford, Jno. Deane, Jr., E. Denning, H. A. Dingle, R. S. Dobbie, F. E. Dolbier, J. W. Doyle, J. Egan, Meno Fedden, T. A. Fowler, C. C. Gartland, W. A. Giles, C. P. Gott, C. F. Green, A. C. Greenburg, C. A. G. Groenback, T. F. Grover, M. W. Grovesteen, N. Hall, J. C. Harris, S. J. Harris, C. E. Hart, J. C. Henry, C. Hermon, A. G. Holcombe, W. E. Lamb, R. Leichman, J. H. Longstreet, A. McKinnon, J. W. McLogan, J. McMahon, M. B. Meddler, E. C. Miller, R. A. Mitchell, A. S. Miskin, H. B. Niles, L. J. O'Reilly, J. G. Palmer, C. W. Raymond, Fred Reed, E. S. Reid, H. F. Salamons, W. Schwein, G. R. Shepard, B. F. Sherman, A. Stamm, E. E. Stark, D. H. Starratt, A. W. Sterger, James Stewart, W. L. Tamblin, C. A. Thompson, J. D. Underhill, H. Van Sands, R. Varley, E. Voelckall, D. H. Washburn, A. V. Waldron, G. C. Webb, C. H. Wright.

ANALYSIS OF THE COST OF THE GENERATION AND DISTRIBUTION OF A UNIT OF ELECTRICITY.*

BY CALVIN W. RICE,
Brooklyn, N. Y.

The speaker has been asked at short notice to give this paper, which, considering the nature of the question, should have several months' labor for its preparation. Consequently no original work could be attempted.

I am fully aware of the responsibility of undertaking such a discussion, and therefore will confine the paper to a resumé of the most reliable data which can be secured from literature by recognized authorities during the last few years.

It is the intent of the paper to show what has been done, what is being done, and what is therefore possible, rather than to give theoretical tables. It is the intent also to show the advantage of watching each one of the various items which go to make up the total cost, and, by pointing out the proportions of each to the whole, to aid one in the discovery as to which particular items are disproportionately large in his plant.

Before taking up the consideration of the cost of operation of a plant we should first consider the plant itself.

TOTAL INVESTMENT PER KILOWATT.

In America the variation in the investment per kilowatt is \$200 to \$750 per kilowatt capacity installed. In a few cases the figure is below \$200, and in a few as high as \$1,000; but in the great majority of cases the cost is below \$400.

In this respect American practice is ahead of that of Great Britain and the Continent, where the majority of plants have a total investment of over \$500 per kilowatt installed.

Later in this paper are given figures on some railway plants in Chicago costing less than \$75 per kilowatt. I think these figures refer to stations alone, whereas the corresponding values for lighting plants include distributing systems also.

The importance of keeping down the investment per kilowatt need not be emphasized.

The principal items that go to make up the total investment are real estate, steam or water power plant, electric plant distributing system and minor details.

In the first item we naturally find a great variation in the different plants. In country towns it runs as low as \$25 per kilowatt, and in cities as high as \$150 and over. In other words, there are some plants where the investment in real estate alone is greater per kilowatt than the entire investment is in others.

The investment in steam plant varies from \$20 to \$60, with figures on the electric plant slightly greater.

It is needless to say that the location of the plant ought to be considered with reference to all influences, each considered separately and reduced to a common method of comparison, i. e., the dollars and cents value per year of each consideration.

For instance, in a large city which I visited a couple of weeks ago I observed a new station being erected not over 1,000 feet from a river, yet five or six 1,000-horse power non-condensing engines were being installed. It is reasonable to assume that the convenience of that site to the main street of the city had a greater dollars and cents value than the consideration of condensing plus the difference in value of the land, as the company had the option to sell the present power site to the Government and to buy a river site for less money.

In buying the steam and electric plant, however, it is essential to consider reliability above every other consideration. In emphasizing this

point, to make it the end sought while considering the merits of boilers, engines, water wheels or generators, it should be viewed in its broadest sense. It is of assistance in examining bids on electrical apparatus or engines to compare the prices per pound, and weight in pounds per kilowatt or horse power and in considering boilers, heating surface and pounds per horse power as well as price per pound.

The various methods of rating apparatus and of stating ability to stand overloads are very confusing to the purchaser, and comparison by pounds develops features not otherwise noticed but worth considering carefully.

Having decided whether or not it is economical to use simple compound or condensing engines, decision as to the boiler pressure will follow as a matter of necessity, and will in turn decide in part whether return tubular or water-tube boilers will be advisable. The price per horse power of boilers is now not widely different.

The advantage of direct connecting over belt or rope drive is now recognized, so very little need be said. The amount of saving has been very carefully sought by Mr. Crompton, and in 23 of the largest English works the results have been tabulated as follows:

COMPARISON OF FUEL USED. Converted Alternating Current System.

WORKS.	Cost of fuel per unit sold. Cents.	B. T. U. in fuel per unit.	Efficiency of distribution.	B. T. U. per unit generated.	Description of Plant.
Newcastle and district.....A	1.60	310	70	218	Steam turbine.
Leeds.....B	2.46	301	66	200	Alternat'r rope-driven.
Bournemouth.....C	3.62	232	69	160	" "
House to house.....D	3.86	265	66	175	" "
Newcastle-on-Tyne.....E	1.28	262	66	178	" "
Metropolitan.....F	3.60	232	68	158	Mixed system.
Eastbourne.....G	2.84	180	60.8	109	Alternat'r rope-driven.
Exeter.....H	2.70	135	66	89	" "
Average of B, C, D and F.....		245	..	161	" "

Mixed System.

City of London.....I	2.48	173	82	141	Mixed system dr.
Chelmsford.....J	1.92	146	76	112	" "
Average of I and J.....		159	..	126	" "

Converted Continuous.

Chelsea.....K	2.22	142	..	..	Dynamos driven direct.
Oxford.....L	1.40	88.5	62	55	" rope-driven.
Average of K and L.....		115	..	..	" "

Direct System.

Preston.....M	2.30	215	93	255	Dynamos dr. dir. by d'ble act. eng.
Liverpool.....N	1.90	188	75	153	Single acting engine.
Birmingham.....O	1.76	183	75	140	" "
Charing Cross and Strand.....P	2.26	147	90	132	" "
Hove.....Q	2.52	147	82	120	" "
St. James and Pall Mall.....R	1.74	116	95 1/2	110	" "
Bradford.....S	1.32	119	88 1/2	110	" "
Brighton.....T	1.81	117	80	94	" "
Kensington.....U	1.74	116	86.5	100	" "
Westminster.....V	1.56	104	88	92	" "
Knightsbridge.....W	1.25	84	91.5	78	" "
Average of N to W.....		133	..	112	" "
Ideal Works.....	0.54	36 1/4	93	32.6	" "

This table shows that the cost of fuel averages 46 per cent. higher where the dynamos are rope-driven than where the dynamos are direct-driven by high-speed engines.

Great stress is nowadays put upon high efficiency, and while this is important, reliability should be the principal feature.

In the present day of good design there is at best little to be gained in absolute efficiency, but the cost of energy and the popularity of electric light and power will be very much affected according as it is reliable.

Good regulation in the station is more important than high efficiency. Good regulation in the station means ability to use high efficiency lamps.

The use of 50-watt instead of 58-watt lamps means a saving of 14 per cent. directly in the lamps and in the copper losses. Relatively this increase in efficiency is much greater than is possible in any of the various types of boilers, engines or generators. Therefore the governing of the engine from no load to full load, and the regulation of the generators with load thrown off and on, should be carefully determined.

The value of accessories in the reliability of the plant and the reduction of labor and attendance is important. These accessories are as follows:

I. Feed-water appliances: (a) injectors; (b) steam pumps; (c) electric pumps.

II. Boiler appliances (steam or electric): (a) forced

draught; (b) mechanical stokers; (c) super-heaters; (d) coal handling and storage; (e) ash conveyors.

III. Cranes: Mechanical or electrical.

IV. Auxiliary electrical apparatus: (a) boosters; (b) station motors.

It is not ever advisable to drive the exciters from a motor taking current from the main generators on account of fluctuations being multiplied.

But under certain conditions the feed pumps, coal and ash handlers, overhead cranes and stokers may be driven with success and economy by either alternating or direct current electric motors.

Electricity as delivered at the switchboard is generated with economy and can be used more advantageously than steam. The inefficiency of steam is illustrated in the following table, showing the indicated horse power and steam per indicated horsepower of some of the auxiliary apparatus of the U. S. S. Minneapolis.*

Name of Auxiliary.	I. H. P.	Steam per I. H. P.
Pump of starboard condenser.....	1.23	266
Circulating pump engine.....	19.	55
Starboard air pump.....	6.5	183
Center air pump.....	25.	78
Vertical duplex fire pump.....	1.	205
Horizontal duplex fire pump.....	0.8	319
Same pump.....	6.4	156
Vertical duplex bilge pump.....	2.5	171

Fireroom feed pump.....	8.8	91
Same pump.....	1.6	243
Forced draft blower engine.....	16.	77
Single cylinder horizontal flushing pump.....	1.4	194
An ice machine.....	6.	70

The use of an oil-distributing system reduces amount of oil consumed and the attendance required. The air-blast for cleaning around generators is a great assistance, saves time, labor and acts as an insurance against burn-out.

This apparatus can now be bought in a combined form so that the same air compressor and tanks furnish air for the oil circulation and for cleaning.

DISTRIBUTION SYSTEM.

From the station let us go to the cost of the distributing system, which is now becoming an enormous item of expense since underground conduits are required in many places. I give the following curves, showing the cost per foot of construction under Belgian block and asphalt, and with various materials of conduit. The cost of underground construction complete is about four times that of overhead construction.

In the choice of duct and insulation on con-

* Steam consumption of the auxiliary apparatus of the U. S. S. Minneapolis, p. 383, March 26, Elec. World, 1898.

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

ductors, again let me emphasize the importance of reliability. With such an enormous investment it is almost out of the question to consider material liable to break down.

In the tests which should be required of the cable two important features should be made prominent. First, the testing apparatus should be at least about 50-kilowatt capacity. The 7 and 8 kilowatt testing transformers which up to within a few years were considered sufficient were a delusion. When it is stated that a cable must stand a test pressure it should be required that that test pressure be maintained at least one hour, as the momentary test is not sufficient to develop faults. Make the insulation resistance requirements moderate, but insist on the test pressure from a large transformer being maintained one hour.

In the matter of joints employ only the most skilled labor.

PLANT MANAGEMENT.

Cost per unit in what follows refers to 1,000 watts maintained one hour, according to Mr. Crompton's arrangement.

The price charged per unit is made up of cost and profit.

The cost may be subdivided as to—

I, Generation and distribution; II, Maintenance, and III, Management.

It may again be divided into (a) material and (b) labor; (a) representing (1) fuel, (2) water and (3) supplies; (b) representing (4) wages and (5) superintendence.

II, Maintenance is made up of (6) material, (7) wages and (8) superintendence, and

III, Management, may be subdivided as to (9) directors, (10) salaries and (11) expenses.

Total cost or Price.	I. Generation and Distribution.	(a) Material.	(b) Labor.	II. Maintenance.	III. Management.	IV. Profit.
		(1) Fuel.	(2) Water.	(3) Supplies.	(4) Wages.	(5) Superintendence.
		(6) Material.	(7) Wages.	(8) Superintendence.	(9) Directors.	(10) Salaries.
		(11) Expenses.	(12) "on capital.			

As we compared total cost of plant per kilowatt and found it on the average to be under \$400, calculations as to cost of operation of plant per unit output per year gives that figure to be, on the average, under 50 cents. That is, on the average it requires 50 cents worth of plant to generate and distribute one kilowatt hour per year.

This immediately brings out an important point, namely load factor. This feature has been brought out with advantage by Mr. Hammond from data of the English companies. Such data is not obtainable yet in America, so I quote in full from Mr. Hammond's paper:

LOAD-FACTOR.

"Former writers have not failed to dwell upon the marked effect which the load-factor has upon the costs of production, and in my estimation of the influences which bear upon that problem I place load-factor directly after output. Without the latter the most favorable load-factor is useless, but, combined with a healthy output, a favorable load-factor greatly reduces costs.

"So convinced is Mr. Arthur Wright of the importance of load-factor that he offers to supply all his customers at 3 cents per unit for any consumption beyond an average of one hour per day of their maximum demand throughout the year.

"The advantages arising from a high load-factor are however universally acknowledged, and I therefore pass on to lay before you the data in connection with it that I have been able to collect.

"These data are not demanded by the Board of Trade, and I am much indebted to those works engineers who have responded to my request for information on this head.

"I use 'load-factor' in the sense of the ratio of the actual units generated to the product of the

maximum of the year and the total hours of the year; the 'load-factor,' therefore, of 1896, being obtained by multiplying the maximum load of 1896 by 8,784 (i.e., 366 days by 24 hours), and of 1897 by 8,760.

"Though it appears to be the custom at every works to record the maximum load, the 'units generated' are in the majority not arrived at by meter, but by calculation, and in some by a process which one of my correspondents describes as 'cooking.'

"Under these circumstances I have hesitated about dealing with the data, but, finally, being convinced of the absolute accuracy of a portion, and of the approximate accuracy of the bulk, I have decided to set it out (see table), leaving the members of the Institution to convince themselves in particular cases as to whether the 'units generated' have been arrived at in an accurate manner."

Table Showing (a) Load Factor and (b) Units Used in Distribution—Provincial Undertakings.*

WORKS.	Year.	Units sold to consumers, including public lighting.	Total units generated.	Maximum load of year. Kilowatts.	Load factor, % of units generated to output of maximum load in use constantly throughout the year.	Ratio of units used in distribution to units generated per cent.
Aberdeen.....	1896	210,185	236,649	343	7.85	9.1
Aberdeen.....	1897	287,072	317,552	369	9.82	7.4
Ayr.....	1896	124,924	191,886	129	16.93	36.1
Bedford.....	1896	158,238	208,106	200	11.84	18.7
Bedford.....	1897	255,940	312,354	270	14.47	19.2
Blackpool.....	1896	403,667	596,340	500	11.50	31.7
Blackpool.....	1897	651,942	731,239	800	10.43	11.6
Bournemouth.....	1896	281,310	394,724	401	11.20	26.2
Bournemouth.....	1897	314,406	513,248	486	12.65	31.7
Bradford.....	1896	813,623	874,525	1,040	9.59	1.8
Bradford.....	1897	963,584	1,101,496	1,123	11.22	1.4
Brighton.....	1896	1,388,821	1,633,576	1,235	14.53	14.1
Brighton.....	1897	1,992,527	2,440,171	1,763	15.80	13.1
Bristol.....	1896	650,758	861,156	766	12.99	2.5
Bury.....	1897	64,162	71,790	91	9.00	32.2
Cheltenham.....	1896	105,500	179,000	157	12.98	25.1
Coventry.....	1896	51,114	79,114	103	9.00	30.0
Coventry.....	1897	79,583	128,845	126	12.82	22.82
Dover.....	1896	154,200	207,027	154	15.31	.....
Dover.....	1897	234,074	317,190	.....	.....	.....
Dublin.....	1896	473,547	718,074	511	15.99	82.10
Dublin.....	1897	518,312	760,067	541	16.04	29.86
Dundee.....	1896	254,278	319,149	346	10.50	11.97
Ealing.....	1896	246,902	379,857	350	12.98	32.16
Eastbourne.....	1896	208,094	359,288	221	18.56	39.42
Eastbourne.....	1897	240,806	402,068	257	17.09	37.14
Edinburgh.....	1896	1,721,573	1,917,504	1,621	13.48	7.00
Halifax.....	1896	177,500	259,740	242	12.21	25.41
Halifax.....	1897	240,000	331,000	296	12.12	20.43
Hanley.....	1896	247,881	320,905	325	11.24	21.37
Hanley.....	1897	351,762	400,590	376	12.16	10.98
Hastings.....	1896	294,000	400,360	266	17.13	25.86
Hastings.....	1897	338,705	466,362	310	17.17	26.32
Hove.....	1896	195,915	239,779	253	10.78	12.32
Hove.....	1897	268,243	311,129	310	11.45	10.40
Kingston-on-Thames.....	1896	155,681	178,681	152	13.46	9.51
Kingston-on-Thames.....	1897	194,268	221,268	203	12.46	9.01
Lancaster.....	1896	98,977	110,932	119	10.61	7.72
Lancaster.....	1897	134,717	146,631	190	8.80	5.88
Leeds.....	1896	883,280	1,190,000	1,010	13.44	27.48
Manchester.....	1896	2,508,588	3,028,357	2,738	12.02	8.86
Newcastle District.....	1896	503,894	900,197	559	18.33	39.88
Newcastle District.....	1897	600,971	1,041,729	464	26.96	34.27
Newcastle-on-Tyne.....	1896	535,953	864,013	580	16.95	34.65
Newcastle-on-Tyne.....	1897	669,906	1,054,600	700	17.15	35.59
Newport.....	1896	195,432	283,089	192	17.45	28.29
Nottingham.....	1896	171,634	183,694	255	8.20	5.00
Nottingham.....	1897	297,185	316,638	400	9.01	5.00
Oxford.....	1896	260,595	426,066	321	15.14	38.69
Oxford.....	1897	313,037	511,845	392	15.02	33.68
Pontypool.....	1896	35,011	38,231	68	6.39	5.82
Pontypool.....	1897	40,483	44,776	75	6.81	6.39
Portsmouth.....	1896	839,392	990,490	660	15.57	.....
Preston.....	1896	320,500	349,920	354	11.28	4.83
Preston.....	1897	371,301	408,111	428	10.80	5.95
Reading.....	1896	82,165	95,351	178	6.16	9.88
Reading.....	1897	123,702	138,947	216	7.37	7.68
Richmond.....	1896	97,044	105,771	135	8.92	6.46
Richmond.....	1897	138,916	152,052	185	9.38	7.27
Salford.....	1896	111,142	245,397	231	12.12	47.63
Sheffield.....	1896	483,427	636,977	648	11.27	23.99
Sheffield.....	1897	747,063	1,013,458	886	13.44	28.37
Southampton.....	1896	131,848	157,550	187	9.59	14.09
Southport.....	1896	845,515	1,055,864	257	14.91	24.28
South Shields.....	1897	109,543	138,379	126	12.53	15.67
Sunderland.....	1897	146,440	216,282	224	11.00	16.82
Taunton.....	1894	126,840	164,394	146	13.01	19.01
Taunton.....	1897	140,019	178,562	165	12.35	17.93
Walsall.....	1894	67,170	110,491	94	13.38	32.71
Walsall.....	1897	96,376	145,606	155	10.72	27.53
Whitehaven.....	1894	178,378	199,051	126	17.98	8.87
Whitehaven.....	1897	178,072	199,473	170	13.39	7.72
Worcester.....	1896	333,644	424,221	310	15.57	20.02
Worcester.....	1897	408,830	559,275	336	19.00	25.97
Yarmouth.....	1897	190,000	271,420	213	14.54	25.28
Metropolitan Undertakings.						
Charing Cross.....	1896	1,944,402	2,305,721	1,066	24.62	12.98
Charing Cr. ss.....	1897	2,615,508	3,167,214	1,378	26.25	14.45
Hampstead.....	1896	893,233	515,578	440	18.84	21.46
Islington.....	1897	503,572	648,929	585	12.66	15.39
St. James.....	1896	2,401,481	2,687,968	2,052	14.91	9.59
Westminster.....	1896	8,503,054	4,060,184	8,000	15.44	12.65
Westminster.....	1897	4,355,781	5,046,500	8,650	15.78	12.47

*From paper by R. Hammond, before Institute of Electrical Engineers, March 24, 1898.

From these tables there is another point to be learned, namely, the percentage of units generated the distribution. I have no doubt but that a great saving may be made in our stations if attention is

brought to this feature. To go back to the total cost per unit, we find, comparing again the English stations, as I have been unable to obtain such data on American stations [see table "Record Costs—Total Costs," next column].

We find the cost of coal varies from \$3.50 to \$5 per ton, and yet the cost of fuel per unit has been kept down in a great many plants to one cent. So far as I am advised there is only one State in our Union which gives such data officially, namely, Massachusetts.

A very interesting report of one of the Continental plants is that of the polyphase station of the Budapest Allgemeine Electricitäts Gesellschaft.

* This station has been in operation since 1893. The electric light in Budapest is supplied by two large central stations, one working on the polyphase system and the other on the simple alternating system. The polyphase currents are transformed into continuous currents by rotaries to 230 volts on the three-wire system.

The station consists of six 300-kilowatt, two-phase generators driven by triple expansion engines. The coal is Ostrauer nut and makes 7.4 per cent. refuse. On an average during the winter months the efficiency of the entire system is 67 per cent. The results of the plant are given in the following table:

	1891.	1893.	1896.
Gross production.....	1,201,000 units	1,900,000	2,800,000
Highest load.....	15,000 16-c. p. l.	17,000	21,000
Lowest load.....	2,000 16-c. p. l.	3,000	9,000
Gross watt-hours per lb. of coal.....	432	575	571

Consumers pay 20 cents a unit for light and 16 cents for power.

† I give below the average cost of coal and contract price per arc lamp per year in about 100 stations in the United States. No distinction in price per 2,000 or 1,200 candle power is made in averaging on account of the great variation in price; a 2,000 candle power lamp in one place with high-cost coal sometimes selling for less than a 1,200 candle power with low-price coal:

State.	Hours per year.	Coal per ton.	Contract price per year.	C.P. per hr. for arc.
Alabama.....	4,000	\$1.92	\$89	\$0.22
Arkansas.....	3,396	2.30	121	.084
California.....	2,855	7.00	120	.015
Colorado.....	3,413	3.18	129	.012
Connecticut.....	2,730	4.28	86	.035
Delaware.....	4,000	2.32	110	.028
District of Columbia.....	4,000	.....	106	.027
Florida.....	2,179	Wood	118	.054
Georgia.....	3,434	1.36	84	.034
Idaho.....	4,000	W. P.	114	.028
Illinois.....	2,789	1.19	77	.031
Indiana.....	2,682	1.79	79	.033
Iowa.....	2,870	1.57	86	.032
Kansas.....	2,734	2.02	97	.040
Kentucky.....	3,063	1.20	88	.032
Louisiana.....	4,000	2.38	128	.032
Maine.....	2,629	5.00	67.5	.031
Massachusetts.....	2,705	4.05	93.8	.037
Maryland.....	4,001	3.00	128	.032
Michigan.....	3,465	2.70	77	.024
Minnesota.....	3,133	3.41	98	.034
Mississippi.....	2,179	2.33	102	.047
Missouri.....	2,919	2.54	83	.032
Montana.....	4,000	4.10	131	.078
Nebraska.....	2,894	2.21	109	.041
Nevada.....	3,640	9.50	144	.039
New Hampshire.....	2,583	4.42	81.5	.036
New Jersey.....	3,615	2.70	105	.032
New Mexico.....	3,255	3.92	128	.045
New York.....	3,387	2.87	94	.028
N. Carolina.....	2,572	3.30	97	.029
North Dakota.....	4,000	6.35	120	.030
Ohio.....	3,359	1.56	79	.025
Oregon.....	3,649	W. P.	1.8	.135
Pennsylvania.....	3,931	1.54	86	.022
Rhode Island.....	3,912	3.85	102	.037
South Carolina.....	3,088	2.65	83	.031
South Dakota.....	3,680	5.00	125	.044
Tennessee.....	4,000	2.08	88	.022
Texas.....	3,472	3.13	109	.037
Utah.....	3,545	2.63	75	.023
Vermont.....	2,254	4.37	85	.039
Virginia.....	3,723	3.07	76	.022
Washington.....	3,479	2.73	128	.039
W. Virginia.....	3,089	.90	79	.017
Wisconsin.....	3,037	3.13	81	.030
Wyoming.....	3,515	1.58	166	.052

Total averages..... 3,325 \$3.03 \$101 \$0.34 580
46 States—1,000 central stations.

† Statistics on English lighting plants:

	Cost Plant per kw. installed.	Cost per Unit.	Average Selling Price.
Bristol.....	915	\$517	6.38c.
Brighton.....	1,200	601	4.72c.
Bradford.....	1,400	255	4.45c.
Dover.....	525	270	8.84c.

* London Electrician, June 18, 1897.

† General Electric Company Lighting Dept. Statistics.

‡ Electrical Engineer, p. 393, April 14. Claud P. D'Oyly.

The highest point for cost of fuel of any of these enterprises was 3.24 cents per kilowatt hour, and

The points of interest in the table are:
1st. Cost of coal. This averages one-half cent per

Record Costs—Total Costs.*

Units sold. Kilowatt Hours. Between.	Place.	1894. Year of operation.	Cost per unit sold.	Place.	1895. Year of operation.	Cost per unit sold.	Place.	1896. Year of operation.	Cost per unit sold.
100,000 and 200,000	Norwich.	First.	5.08c.	Burnley.	Second.	4.44c.	Whitehaven.	Third.	8.50c.
200,000 and 350,000	Leeds.	Second.	6.22	Dundee.	Third.	4.63	Preston.	Fourth.	8.88
350,000 and 600,000	Brighton.	Third.	4.60	Leeds.	Second.	4.10	Norwich.	Third.	4.22
600,000 and 1,000,000	Kensington.	Fourth.	5.72	Edinburgh.	First.	3.34	Portsmouth.	Second.	8.42
1,000,000 and 1,500,000	Manchester.	First.	4.34	Edinburgh.	Fourth.	4.42	Glasgow.	Fifth.	8.84
1,500,000 and 2,000,000	St. James.	Fifth.	5.84	Manchester.	Second.	3.60	Edinburgh.	Second.	2.26
2,000,000 and 2,500,000	Westminster.	Fourth.	5.38	Manchester.	.....	.....	St. James.	Seventh.	4.58
2,500,000 and 3,000,000	Metropolitan.	Sixth.	9.04	Westminster.	Fifth.	4.62	Manchester.	Third.	2.90
3,000,000 and upward	.....	.....	.....	C. of London.	Fourth.	7.00	Westminster.	Sixth.	4.18

* Hammond.

the lowest 1.08 cents; but the conditions are so different that an analysis cannot be made, although the Brighton plant is one which is handicapped.

unit. This is less than in the ideal station of Mr. Crompton. We get the advantage of cheaper coal in America. The wages item is less in these railway

*RAILWAY PLANTS—COST PER UNIT.

Station.	Boilers.	Pressure.	Style of engines.	Cond. or non-cond.	Style of generators.	Coal.	Cost of coal per net ton.	Pounds of coal per unit.	Pounds water per unit.	Cost of coal.	Operating supplies exclusive of coal.	Labor operation.	Supplies, maintenance.	Maintenance labor.	Maintenance buildings.	Total.
A W. T. 160	Cross comp.	Tripl.	C. rect.	Anth.	.....	.....	\$2.40	2.60	7.6	\$.0028	\$.0005	\$.0024	\$.0003	\$.0001	\$.0001	\$.0061
B W. T. 160	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	3.50	3.50	9.8	.0052	.0008	.0023	.0006	.0005	.0002	.0096
C W. T. 160	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	2.40	3.11	7.7	.0033	.0008	.0044	.0002	.0005	.0001	.0093
D W. T. 160	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	3.15	3.65	9.3	.0051	.0009	.0030	.0001	.0001	.....	.0092
E W. T. 160	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	2.07	3.50	8.0	.0033	.0010	.0043	.0003	.0006	.0001	.0096
F W. T. 140	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	2.90	3.80	9.3	.0056	.....	.....	.....	.....	.....	.0100
G W. T. 140	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	3.23	4.00	9.4	.0065	.....	.....	.....	.....	.....	.0109
H W. T. 150	Cross comp.	Tripl.	C. Belt	Anth.	.....	.....	3.06	4.40	8.5	.0068	.....	.....	.....	.....	.....	.0112
I W. T. 150	Cross comp.	Tripl.	C. rect.	Anth.	.....	.....	2.69	4.20	.....	.0050	.0006	.0042	.0002	.0004	.0001	.0105
J W. T. 160	Cross comp.	Tripl.	C. rect.	Anth.	.....	.....	1.40	6.20	6.9	.0057	.0004	.0033	.0004	.0001	.....	.0098
Average.....	.....	.....	.....	.....	.....	.....	2.68	3.90	8.6	.0049	.0007	.0034	.0003	.0003	.0001	.0097

*January, 1897, Street Railway Journal, L. D. Tandy.

A, B, C and E are large stations, containing the most expensive machinery. No expense has been spared in their construction, and in consequence fixed charges are extremely high.

Station D is a representative city station of moderate cost and high efficiency.

Stations F, G and H are city stations of moderate cost. They are not of absolutely modern construc-

plants than any English lighting station, but it should be remembered that the figures on these railway stations refer probably to generation only.

If we take the pounds of coal per unit and divide 1,000 watt-hours by it, we will obtain 256.

At this point it is interesting to turn back to your 1896 meeting in New York and to the paper by Mr. Swetland, chairman of the Committee on Data.

Operating Expenses.							Fixed Charges.					
No. of Plant.	Fuel.	Wages.	Supplies.	Repa. rs.	Water.	Total.	Interest.	Depreciation.	Insurance	Taxes.	Total.	Cost per Horse Power.
1	\$.00367	\$.00154	\$.00024	\$.00081	\$.00013	\$.00640	\$.00038	\$.00049	\$.00015	\$.00009	\$.01006	\$.00749
2	.00316	.00191	.00057	.00016	.....	.00680	.00037	.00040	.00022	.00014	.00113	.00693
3	.00445	.00348	.00122	.00044	.00036	.01195	.00171	.00151	.00032	.00063	.00417	.01613
4	.01594	.02740	.00297	.00053	.00135	.04820	.00308	.00379	.00082	.00079	.00828	.05648
5	.00778	.01376	.00198	.00033	.00053	.02440	.00218	.00188	.00052	.00020	.00478	.02918
6	.00455	.00738	.00068	.00072	.00028	.01261	.00077	.00124	.00062	.00015	.00279	.01641
7	.00296	.00222	.00014	.00051	.00002	.00585	.00062	.00131	.00006	.00006	.00235	.00820
8	.00402	.00216	.00013	.00016	.00017	.00664	.00065	.00116	.00026	.....	.00207	.00871
9	.00157	.00148	.00031	.00040	.....	.00377	.00149	.00146	.00040	.....	.00336	.00713
10	.00441	.00081	.00104	.00123	.....	.01650	.00530	.00522	.00015	.00094	.01161	.02811
11	.00093	.00022	.00045	.00016	.....	.00986	.00301	.00323	.00016	.00081	.00722	.01708
12	.01276	.00910	.00112	.00094	.00023	.02415	.00062	.00343	.00155	.00058	.00918	.03333
13	.00611	.00532	.00049	.00040	.00057	.01190	.00152	.00199	.00025	.00030	.00406	.01596
14	.00608	.00083	.00109	.00044	.00075	.01520	.00133	.00164	.00020	.00026	.00350	.01898
15	.00181	.00256	.00085	.00036	.00003	.00661	.00055	.00110	.00005	.....	.00171	.00832
16	.00178	.00244	.00044	.00018	.00011	.00494	.00051	.00065	.00024	.00006	.00145	.00639
17	.00258	.00062	.00018	.00007	.....	.00345	.00078	.00079	.00008	.00021	.00186	.00531
18	.00292	.00074	.00021	.00009	.....	.00396	.00124	.00133	.00006	.00032	.00295	.00691
19	.00377	.00107	.00027	.00019	.....	.00530	.00068	.00068	.00008	.00025	.00227	.00757
20	.00296	.00076	.00028	.00053	.....	.00453	.00069	.00109	.00007	.00019	.00224	.00677
21	.00261	.00065	.00016	.00008	.....	.00370	.00091	.00104	.00005	.00020	.00230	.00690
22	.00301	.00076	.00046	.00109	.....	.00532	.00103	.00114	.00008	.00037	.00262	.00794

NOTE.—This table should follow the tables on p. 374, headed "Output."

tion, but at the time of their erection were as perfect as money could make them.

Station I is a model station of small size, running an extremely variable load.

Station J is a large city station running under favorable conditions.

From the examination of 81 reports using coal as fuel the average efficiency is 108 watt-hours per pound of coal.

We are thus able to compare these two series of stations and find that the average efficiency of the lighting is less than half the railway companies'.

also that the average of these railway stations is above the highest efficiency of the 1896 report, but was equalled in 1895 in the report of one lighting station only.

It is interesting to compare these reports with the

It will be seen that in rated capacity the plants vary from 40-horse power to 2,500, and in value per rated horse-power from \$23 to \$89 in steam power plants, or as high as \$368 in waterworks pumping stations.

In fuel, soft coal or slack of soft coal largely predominates, and a considerable use of mixtures of the latter with dust from the yards and hard coal slack will also be noticed, which is largely due to efforts to reduce the smoke nuisance.

POWER PLANT EQUIPMENT, ENGINES, VALUES AND LABOR.

Engines.										Values.			Labor.			Purposes for which steam is used other than for power from same boilers, at same time.
No. of plant.	No. of engines.	Type.	How run.	Cylinder.				Revolutions per minute.	Rated h. p.	Total power plant.	Per rated h. p.	Engines.		Fireman etc.		
				Diameter, high, inches.	Diameter, low, inches.	Stroke, inches.	No.					Rate per month.	No.	Rate per month.		
1	1	Corliss.....	Non-condensing	22		48	80	380	\$14,865	\$39.12	2	78	2	3	Exhaust heating, during winter.	
2	1	Cummers.....	Condensing	22 1/2		42	78	250	11,000	44.00	2	78	2	45	Steam tables, elevator and other pumps.	
3	1	Corliss.....	Non-condensing	16		36	86	125	18,300	89.27	1	125	2	42	Steam tables; exhaust for building in winter.	
4	1	Slide valve.....	Used occasionally	12		20	162	80		2.337	58.42	1	65		Steam tables and neighboring building	
5	1	Slide valve.....	Non-condensing	12		16	125	40		1.500	23.08	1	90		Steam tables; heating building in winter.	
6	1	Compound automatic.....	Non-condensing	8	14	14	194	65		10.143	46.10	1	125	1	52	Elevator and other pumps.
7	1	Vertical.....	Non-condensing	16 1/2		20	74	65				2	65	1	40	
8	1	Vertical compound.....	Condensing	15	30	20	60	100				1	125	1	52	
9	1	Straight line.....	Non-condensing	10		16	235	60				2	65	1	40	
10	1	Ball.....	Non-condensing	10		12	275	60								
11	1	Corliss compound.....	Condensing	30 1/2	56	60	68	1,500	100,000	40,000	1	100	4	55		
12	1	Corliss compound.....	Condensing	26	42	48	75	1,000				2	75	4	50	
13	1	Wheelock.....	Non-condensing	17		38	100	165	11,200	67.88	1	45	1	36		
14	2	Holly double compound.....	Condensing	34	72	48	16		632,000	287.90	1	167	9	61		
15	1	Holly double compound.....	Condensing	33	66	47	16				3	87	2	40		
16	1	Worthington compound.....	Condensing	38	66	50	10				1	40	6	40		
17	1	Worthington compound.....	Condensing	29	50	50	10				1	45				
18	2	Holly compound.....	Condensing	12	24	22	21		40,478	367.96	1	100	2	45		
19	2	Holly compound.....	Condensing	12	24 1/4	22	19		28,100	254.54	1	100	2	48		Part of last year for electric power station in same building.
20	1	Slide valve.....	Non-condensing	28		36	78	300	9,500	31.66	1	78	1	45		For small electric light plant occasionally.
21	2	Compound automatic.....	Non-condensing	8	13 1/4	12	235	65	7,730	46.85	1	100	1	43		For elevator and other pumps and to help exhaust in winter.
22	1	Westinghouse.....	Non-condensing					35			2	65				
23	1	Buckeye.....	Non-condensing	12		22	140	65	4,500	69.23	1	25	1	48		For heating ovens and part of building.
24	1	Slide valve.....	Non-condensing	12		12	260	80	3,000	37.50	1	48				To help exhaust in winter. Exhaust used for dry rooms all the year.
25	1	Wright.....	Non-condensing	22 1/4		42	68	200	7,000	35.00	1	78	1	45		To help exhaust in winter. Exhaust used for dry rooms all the year.
26	1	Corliss triple compound.....	Condensing	24	1-34 1/2	60	62 1/2	1,200	57,500	47.92	1/2	100	2	35		1st. asst. eng. at \$32 and 1 coal wheeler at \$30.
27	1	Corliss dbl. tand. comp.....	Condensing	22 1/2	40	60	68	1,000	71,434	71.43	1	75	2	35		One oiler at \$35 for slashers and vapor.
28	1	Corliss double.....	1/2 condensing	22 1/2		60	54	600			1	75	2	39		Exhaust from one cylinder of Nos. 1 and 2 for slashers.
29	1	Corliss double.....	1/2 condensing	22		60	64	600			1	100	2	32		Live steam for heating and vapor.
30	1	Corliss cross compound.....	Condensing	24	44	60	63	800			1	50	1	42		Watchman at \$48.
31	1	Corliss cross compound.....	Condensing	22	40	60	65.8	500	146,550	58.75	2	42	3	36		One coal wheeler at \$30.
32	1	Corliss cross compound.....	Condensing	28	52	60	66 1/4	1,300			1	90	3	26		Exhaust from slashers and vapor.
33	1	Corliss double.....	3/4 condensing	28		60	57	800	110,000	55.00	2	36	2	38		Two wheelers at \$33.
34	1	Corliss cross compound.....	Condensing	28	52	72	63	1,400	68,789	49.14	1	10	2	40		One fireman at \$44, one wheeler at \$47, steam for vapor and slashers.
35	1	Corliss cross compound.....	Condensing	28	52	72	57	1,200	64,000	55.33	1	67	1			

Budapest Gesellschaft, where the lowest efficiency for the last three years is 432 watt hours per pound coal, showing there is yet much to be gained.

Below is the report of some of the Chicago railway plants:*

COST OF OPERATING CHICAGO RAILWAY PLANTS.

	C. C. Ry. Co.	C. C. Ry. Co.	M. W. S. Sta.
	No. 1.	No. 2.	
K. W. capacity..	5,250	5,280	4,500
Cost per K. W. installed.....	73.33	75.75	141.33
Cost of station	\$385,000.00	\$400,000.00	\$363,000.00
Units, output per year.....	1,067,900.	2,375,000.	1,460,000.
Fuel per unit.....	\$.0049	\$.0037	\$.0033
Water per unit.....	.0004	.0003	.0001
Labor per unit.....	.0022	.0007	.0021
Supplies per unit.....	.0001	.0001	.0001
Total.....	.0074	.0018	.0059
Interest.....	.0018	.0008	.0024
Depreciation.....	.0015	.0007	.0008
Total.....	.0083	.0015	.0040
Repairs.....	.00002	.00003	.00003
Total.....	\$.0109	\$.0064	\$.0103

A carefully prepared paper by Mr. Horatio A. Foster on the cost of steam power, and read before the American Institute of Electrical Engineers a year ago, emphasizes the fact that there is very little reliable data on American plants. His results on 22 plants are given in the tables on this page.

The plants on which tests were made for cost of power were:

- Two electric lighting stations.
- One grain elevator.
- Three waterworks pumping stations.
- Two flouring mills.
- Six cotton mills.
- Four newspaper and printing offices.
- One department store.
- One furniture manufactory.
- One bakery.
- One, glazed and fancy paper manufacturing company.

*May, 1897. Street Railway Journal.

OUTPUT.

No. of Plant.	Average H. P. Developed.	Percent of total engine capacity.	No. of days.	Time per day.		Hours per annum.	Operating Expenses.		
				Hours.	Minutes.		Fuel.	Wages.	Supplies.
1.....	296.7	78	297	24	.....	7,128	\$26.20	\$10.95	\$1.66
2.....	210.9	85	290	24	.....	6,960	22.00	13.24	3.94
3.....	58.8	47	365	24	.....	8,135	36.30	44.60	9.90
4.....	12.4	31	361	9	.....	3,067	48.93	94.12	9.13
5.....	21.5	33	361	9	.....	3,711	28.82	51.09	7.34
6.....	70.4	32	365	23	.....	7,461	34.00	55.07	5.09
7.....	1,345.5	54	365	11	.....	4,008	11.75	8.90	.55
8.....	129.3	78	365	12	27	4,544	18.25	9.82	.58
9.....	1,332.	62	365	12	.....	8,730	13.76	13.00	2.74
10.....	36.7	33	365	24	.....	8,327	36.71	81.62	8.70
11.....	42.4	39	365	24	.....	8,755	28.54	54.49	3.66
12.....	173.	58	313	3	.....	8,639	11.98	8.53	1.05
13.....	53.	32	309	15	30	4,790	24.43	25.50	2.35
14.....	20.9	32	365	24	.....	8,110	49.30	55.30	8.83
15.....	32.9	41	330	10	20	3,410	9.58	8.74	2.92
16.....	106.7	84	313	9	53	3,075	5.46	7.48	1.36
17.....	1,174.8	98	304	9	40	2,658	7.62	1.82	.54
18.....	926.	93	307	9	40	2,693	8.64	2.20	.62
19.....	2,422.	97	306	9	40	2,958	11.12	8.18	.81
20.....	1,909.7	95	306	9	40	2,953	8.76	2.26	.82
21.....	1,278.7	91	293	9	40	2,831	7.40	2.41	.46
22.....	1,010.86	84	306	9	40	2,958	8.69	2.24	1.35

No. of Plant.	Operating Expenses.				Fixed Charges.				Cost per H. P.
	Repairs.	Water.	Total.	Interest.	Depre- ciation.	Insur- ance.	Taxes.	Total.	
1.....	\$5.77	\$0.96	\$45.56	\$2.55	\$3.52	\$1.07	\$0.67	\$7.81	\$53.37
2.....	1.13	.....	40.33	2.61	2.80	1.50	.95	7.85	48.19
3.....	3.60	2.90	97.30	13.87	12.24	2.61	5.10	33.82	131.12
4.....	1.62	4.13	147.93	9.46	11.62	1.89	2.43	25.40	173.33
5.....	1.24	1.98	80.47	8.13	6.98	1.94	.75	17.89	108.27
6.....	5.40	2.13	101.69	5.77	9.24	4.62	1.13	20.78	122.45
7.....	2.01	.07	23.28	3.71	5.21	.26	.24	9.42	32.70
8.....	.72	.77	30.14	2.97	5.28	1.16	.....	9.41	39.55
9.....	3.53	.....	33.03	13.10	12.78	3.53	.....	29.41	62.44
10.....	10.22	.....	137.25	44.10	43.40	1.30	7.80	96.70	233.95
11.....	1.39	.....	86.38	26.41	28.29	1.43	7.07	63.20	149.58
12.....	.88	.22	2.66	3.40	3.22	1.46	.55	8.63	31.29
13.....	1.93	2.73	56.94	7.29	9.57	1.19	1.46	19.51	76.45
14.....	3.59	6.10	123.12	10.79	13.33	2.15	2.15	28.42	151.54
15.....	1.22	.10	22.56	1.88	3.76	.19	.....	5.83	28.39
16.....	.58	.31	15.19	1.37	2.02	.74	.14	4.47	19.66
17.....	.21	.....	10.19	2.30	2.35	.35	.60	5.50	15.69
18.....	.27	.....	11.73	3.68	3.93	.20	.96	8.77	20.50
19.....	.56	.....	15.67	2.88	2.85	.25	.75	6.73	22.40
20.....	1.56	.....	13.40	2.62	3.21	.22	.68	6.63	20.08
21.....	.27	.....	10.49	2.57	2.96	.16	.54	6.23	16.72
22.....	\$.12	.....	15.70	3.94	3.36	.24	1.10	7.74	23.44

While the type of boiler used leans largely to the plain, old-fashioned return tubular, with the exception of the cotton mills, the types of engines are almost as varied as the number of plants.

In conclusion I wish to say that if I may have the assistance of the members, by providing me with data, by next year I can prepare a more helpful paper, going more carefully into the question of

calorific value of the different coals used and to the different types of plants.

DISCUSSION.

Mr. Scovil—In the beginning of Mr. Rice's paper is the following paragraph: "In America the variation in the investment per kilowatt is \$200 to \$750 per kilowatt capacity installed. In a few cases the figure is below \$200, and in a few as high as \$1,000; but in the great majority of cases the cost is below \$400." I would like to ask what is meant by the word "investment"?

Mr. Rice—As I understand the data given in the literature which I have quoted, it covers the entire investment of developing water-works if it is a water-works plant, the steam plant, buildings, real estate, distributing system, whether underground or overhead, clear to the motor or insulation in the consumers' plant.

Mr. Scovil—Does it cover royalties?

Mr. Rice—As far as I know it does.

Mr. Ayer—There is a note in the paper where it speaks about the losses or unaccounted watts developed in the lighting station as compared with gas; that the losses are from different sources. I ask Mr. Barker his understanding of it. Is it not a fact that the gas losses are due to condensation quite as much as the watt losses are due to line losses; in other words, are there not in both cases loss in distribution?

Mr. Barker—The occasion for the losses in the gas distribution are largely leakage in the pipe. The matter of condensation loss, if gas is properly made, can be reduced to very low percentage, and the large percentages of loss in cases about which you hear occasionally are due to actual leakage. The causes are somewhat different in gas distribution from those in electric light distribution, although it may be that when electric light distribution is as thoroughly understood and as accurately applied, the losses in electric light distribution may be very largely reduced, as has been the case with gas distribution.

Mr. Dow—I should like to get a certificate of the accuracy of the statement regarding the Budapest system. It gives the gross watt hours per pound of coal as 575 and 571. It is specifically stated that it is gross watt hours and the station is described as a station where the loss would be quite high. Mr. Rice has no doubt given the statement most careful consideration.

Mr. Ferguson—The Budapest station pays more for coal than we do. They pay four or five dollars a ton, so that the figure 571 is possible. It costs them more for coal at Budapest than it does at our best American stations.

Mr. Dow—With all due respect to the Budapest statements, I do not think they are correct. The main engine alone might accomplish that result; it is possible to get them down to about 1.4, but to get the whole output down to such a figure it seems to be out of the question. There is a mistake of about 200 watts.

Mr. Creden—In connection with what Mr. Dow has said, I will say that the Chicago Edison Company generates a kilowatt on about $4\frac{1}{2}$ pounds of coal, equivalent to about 28 lbs., which gives an evaporation of about six lbs. on an average to a day's run. Coal as used in Budapest would safely give about ten lbs. on an average, which readily accounts for the large number of watts generated. The Chicago Edison Company generates about 250 watts per pound of coal. The coal we use will give an evaporation of six lbs., perhaps a trifle less, on a run of 24 hours. The coal at Budapest is of a better quality and will give an evaporation of ten lbs., which will account for the high figure specified. I think the figures presented by Mr. Rice are about right. They are possibly a trifle high, but not as high as Mr. Dow represents.

President Insull—I have here a chart which shows

the average cost of various operations in connection with our operating expenses, except the interest portion of the operating expenses. The largest amount of expenses is general expenses. The reason for that is that one-third of the expense is in getting new business, one-third administrative expenses and the balance insurance, taxes and similar items. Take the question of street repairing, that item will go down continually until you get your system in such shape that that item will not bear any particular relation to the amount of your output unless the output exceeds the capacity of your conductors. The biggest item of expense apart from general expense is, as Mr. Rice indicated, lamp renewals, when he referred to the question of regulation being more important than the question of economy.

The important point that the chart brings out is the interest cost. You might have all of your operating expenses presented to you outside of interest and then you could lose money—it would be possible to do such a thing if your selling price is not on the right basis. Here is a case of a 3.7 load factor. It is an office building and actual case, not an extreme case. I could show you cases where the load factor would be much poorer than that, but in that case the interest charge is 80 per cent. of the total operating charge. Here is the case of an ordinary fancy store (these cases are taken from the actual bills), and you see there that the interest charge is a little less. The importance of the interest charge in this case will be brought home to you when I tell you that the difference between six and five per cent. in the price you pay for your money and whether you sell your bonds at 90 per cent. or sell them at par makes a difference of 16 to 20 per cent. in the cost of operating expenses. That statement alone will show you that the public (generally) is more interested than we are in the question of protecting us in the enjoyment of our right to do business.

Now we come to the all-night restaurant where the load factor is 48 per cent.—the interest charge is only 26 per cent. of the total expenses. These are the two extreme cases I mentioned to you in my opening remarks. In this case (indicating) you could sell current to a man at about a quarter what you could sell it to this man and make more money out of that man than out of this man. You will find that the same relation goes all the way through with the different classes of business. Power business is not quite as good as all-night lighting business. The load factor is about 35 per cent. and the interest expense 32 per cent. With a drygoods store the interest is about 40 per cent. With a small lunch counter the interest is 45 per cent., and with a saloon the interest is 52 per cent.

It is generally supposed that the best business is the power business. I remember in the early days when the rates were established to foster the power business of the Edison Electric Illuminating Company of New York, the claim was made that you could afford to sell power at one-half the price if your current was going to be used for power when it was not going to be used for light. We have found that the power curve and the light curve cross each other for sixty days during the winter, and the claim which was made for the power business proved a fallacy.

In your lighting business—I am talking to people using large stations—you can get a class of business which will yield you a bigger return on your investment from lighting customers than from power customers at a low rate, because the interest cost, if you have a 50 per cent. load factor, is only 25 per cent. of the total cost; whereas with power customers the interest is about 35 per cent. This chart properly studied should enable a man running the Chicago Edison Company to make a price list that would fit all kinds of customers. If we can do that in our business, surely you people can do it in your business. You will find, too, that the adoption of a system of rates that will take care of these different condi-

tions will affect these items very materially. It will not affect lamp renewals, of course. It will certainly affect station repairs, general supervision, station labor, fuel and also general expenses. In other words, it will affect by far the greater proportion of your expenses outside of interest charges, besides very materially affecting your interest charges by putting your revenue on a basis so that it is in proportion to the interest you have to pay to take care of the customer whom you are supplying with current. You are putting your business on a basis so that you get a return on the investment which you have to provide for each separate customer. This subject came up for discussion last year at Niagara Falls. One gentleman, who I am sorry is not here to-day, took the ground that we had to sell the product at the same price to everybody. If you do you are selling your product at different prices to everybody, because in one case you can make money, and in another case you lose money. Take for instance this case. That office-building customer won't enable you to pay interest and depreciation on the investment. You may have to take him as a good business policy; but do not fool yourselves when you put on 5,000 lights in an office building that you are going to make any money on them. We do the largest office-building business in the country, and I am perfectly willing to say to you that I do not believe we make any money, but I would not like to say it to the stockholders. If the expenses of a station are followed out in this way, you can get a great deal more out of the method by which you sell than you can out of the method by which you produce.

Mr. Armstrong—What would you call your standard rate? What would be your base rate?

Mr. Insull—I never expect to sell that man below twenty cents a kilowatt hour unless the conditions of production change.

Mr. DeCamp—Mr. Armstrong means whether you establish a base rate for the least desirable customer and work down, or whether you take a base rate on the most desirable customer and work up?

Mr. Van Trump—How do you distinguish between your customers?

Mr. Insull—It is simply a question whether you are going to do it figuring on lamps connected, which is fallacious, or adopt some scheme which enables you to register the maximum load.

Mr. Hubeley—How can you regulate that plan on a meter basis—different rates for different services?

Mr. Insull—There are various ways of arriving at that.

Mr. Hubeley—I do not see how it could be done on a flat rate, on a contract basis. I do not see how you could do that without a great deal of computation.

Mr. Insull—Do you mean a meter flat rate or contract basis?

Mr. Hubeley—Contract basis; so much a month.

Mr. Insull—We would go into the hands of a receiver on that basis.

Mr. Hubeley—Do you use meters here under that plan?

Mr. Insull—Yes, sir.

Mr. Barker—You spoke of the different classes of business earning a certain percentage on the investment. How do you apportion the investment among the different classes of business?

Mr. Insull—On our maximum output per year. We take an investment of that kind, and divide the one by the other, and get the investment per unit at the maximum output. Then we get the maximum demand on us for current from the customer, and in that way we can figure his load factor. As we know what it costs for our investment per maximum unit of output, and as we know our customer's maximum demand—

Mr. Hubeley—How do you know that?

Mr. Insull—There are a number of ways of arriving at it. We use a Bristol recording wattmeter;

you can use some kind of indicator that will show it. There are a number of ways. We use the Wright demand meter.

Mr. Wendell—In towns of 25,000 people there are a number of small consumers whose maximum demand may not be five lights. They are very desirable customers. What would you do in their case?

Mr. Insull—If your smallest customer is a man who burns one light, and burns it five hours a day, he is likely to buy it at a rate of a little over one half a cent per lamp hour.

Mr. Wendell—How small a customer can you afford to take?

Mr. Insull—It depends upon the efficiency of the lamp. If you will give us a 25-watt lamp, we will take a customer whose demand is 25 watts.

Mr. Wendell—Can you afford to do that with the Wright demand meter? On what number of lamps do you use the meter?

Mr. Insull—Mr. Ferguson, what customers can we afford to take?

Mr. Ferguson—We take every and any customer on that basis, and we have a uniform schedule of prices for everybody, based on one cent per lamp per hour; that is the base rate. We charge the full rate of one cent per lamp per hour for one hour per day as the maximum demand, and for all watt hours beyond that hour we charge a half rate, 40 per cent. or 60 per cent. or anything you please.

In regard to the question of what customers you can afford to take, that would involve a great deal of calculation. The simplest way is to charge a minimum bill to each customer which will cover the smallest customer. If you charge a minimum bill for services furnished, that will cover interest and depreciation charges on the cost of the investment used.

Mr. Scovil—I would like to know whether the chart which you have shown, and the percentages you gave, do not include a great many motors that are used for electric power, such as elevators?

Mr. Creden—Yes, it does.

Mr. Scovil—I simply want to have it understood that Mr. Insull's deductions from his chart as to the desirability of power as a load factor on the station is not altogether to be accepted from the showing made by the chart, for the reason that that chart includes in it many motors used on electric elevators in which the power factor is very small; that motors used for manufacturing purposes only have a much higher power factor, and are entitled to a much better rate.

Mr. Insull—I do not say power is not desirable business.

Mr. Scovil—It is good lighting that is as good as ten-hour motor power ordinarily.

Mr. Insull—I do not wish you to think that we do not take power.

Mr. Coggeshall—You charge one rate for one hour a day and another rate for the rest of the day. How do you do it?

Mr. Insull—That is called the two-rate system. It is done by a meter with two dials or a double meter.

Mr. Wagner—I understand from your remarks that the Chicago Edison Company is going to use the Wright demand system of charging, which is a very thorough way of providing for all these different classes of service. I should like to know if there is any one else here who accomplishes nearly the same thing by any other method.

Mr. Dow—I have been into this thing up to my neck. I suppose that remark will interest a good many members here from small towns, say of 25,000 inhabitants. We have more than 25,000 people but we have not money enough to buy Wright demand meters for all our customers just yet. We are going to do so some day. However, we use demand meters on a number of customers. We use them when there is doubt of arriving at the demand by any other means. We do not believe it necessary to leave

them on continuously, but we put them on long enough to make certain that we have a fair average demand for the current twelve months, and in such cases we make the demand established by meter and base a contract on it with the customers for the current twelve months. We say to them that they shall pay for that amount for twelve months at the maximum rate, and everything beyond that at a minimum rate, and at the end of twelve months we will again meter in the same way, and reserve the right to put the meter on at any time to satisfy ourselves as to what the actual demand is. In some places we leave the meters on continuously. We would do so all the way through but for the one point of not having money enough to put them on everybody.

Mr. Ayer—I think it would be interesting to the members who did not attend the last Convention when the Wright demand system was described to have a brief description of it given here by Mr. Dow.

[Mr. Dow gave a description of the operation of the Wright demand meter. The principle, he said, is the same as that which governs the registering thermometer.]

Mr. Dow—Now to answer the question raised as to how any one has reached the same result by other means. In the matter of arc lighting practically nine-tenths of the business is with customers whose lamps connect, are all turned on at once. If a man has ten arc lights he is likely to use all at the same time, so that in the majority of cases the arc lamps will be an exact measure of the demand. With certain classes of motors the same thing applies, not with all classes by any means, because there is nothing that is more frequent than a motor running at a much less load than it is rated, or they seldom use continuously any length of time the maximum. The matter of elevator motors, to which Mr. Scovil referred, is in that line. There is a large amount of motor business where you can put on an ammeter and ascertain the largest demand. As we are situated now we have been trying to develop the motor business and inspect motors frequently, and we have not so many that a faithful man cannot visit them all in five weeks. We are not missing anything, but our method of checking depends on personal knowledge and can only be looked upon as a makeshift. It does not compare with the method of gauging the arc lights, but as a temporary device it fills the bill. Beyond that you have still another class of customers, small barber shops, saloons, cigar stores, news-stands and fruit stands, that use only a few lights and keep open long hours. They are good customers. Beyond that is the general use of incandescent lights where some meter must be used. It limits the necessity of the application of the demand meters to one part of the business, and that may be one-half or one-third of the whole business. If there is any place in the world where a demand meter is a good thing it is in a residence. In the absence of the meter system in residences we have instituted a method of assessment according to the number of rooms in a house and the number of persons likely to use the light.

Mr. Wagner—How do you arrive at the assessment you speak of?

Mr. Dow—We inspect each house and make a list of the rooms and the number of lights in each room, and we make a charge accordingly.

Mr. Wagner—You have to collect all the data for each customer?

Mr. Dow—With the residence customers only.

Mr. Wagner—We have 75,000 incandescent lamps in St. Louis.

Mr. Dow—We have 24,000.

Mr. Robinson—In formulating a scheme for the adoption of the Wright demand system I found a certain class of business that I did not know how to handle. It comes from lodges, churches, etc.

Mr. Dow—Mr. Wright maintains strongly that the

relation of the demand, maximum customer's demand, and the time at which the demand takes place is of no consequence; but I feel that it is, so I reclassified all these certain lines of business, which include the troublesome customers mentioned who think that they ought to have special rates. I have churches, lodges, schools, banks and fire engine houses on a special basis, in the latter case because we use some of the fire alarm telegraph poles. Our annual peak is due to the sixty days crossing of motor and lighting loads. The banks are off before the great bulk of business comes on. I established for them, on the same set of calculations, a rate which is equitable and known as the church, bank or lodge rate. It is got at in the same way.

Mr. Wagner—I think we might hear more about the details of the system of the Chicago Edison Company.

Mr. Ferguson—Mr. Dow made the statement that he could not afford to buy demand meters. He can do it after a while but cannot afford to do it now. After listening to what he said I think he is much mistaken. I think he is spending too much of his valuable time in attempting to understand the personal characteristics of his customers. I am sure that if he does that properly, if he ascertains the characteristics of his customers so well that he can approach the work done by the Wright demand meter, he must employ a large force of assistants, and when we consider that the cost of the demand meter is small in proportion to the total investment, and when we consider the immense amount of business that can be obtained by using the demand meters, I think he can well afford to buy them. We will suppose that in Chicago we have 5,000 customers and the cost of the instruments would be something like \$30,000 for all these customers. We do not spend all the entire sum in one year, it would take some time. Our business has improved largely by the use of the meter and we cannot get instruments fast enough. We have made contracts on the Wright demand basis and a month has passed and we have not the Wright meters in. If that is so, it seems to me that any central station man can well afford to borrow the money, even at a very high rate of interest, as Mr. Ayer has just suggested, and purchase the meters. The additional business that you will get by the use of such instruments will more than compensate in a few years for the total investment by having an instrument to measure the current properly. We have listened to papers in these Conventions showing the economy to be effected in generation and distribution and that sort of thing. It seems to me that there is more money to be made in the intelligent selling of your product than in attempting to introduce further economies in operation. With an instrument like the Wright demand meter you are put in a position where the instrument does for you what you will otherwise have to do by skilled labor at a very high cost. I say this from experience.

In further reference to this question of dealing individually with customers, especially in residences, upon which Mr. Dow dwelt particularly, the load factor varies greatly and you cannot classify residences; it is almost impossible to do so. We will have a rich man, for instance, like Mr. Armour, who has 200 lights in his house, at \$25 a month, and we have another man with 25 lights and his bill is \$20 a month. They would be entitled to a 25 per cent. discount on the basis of 25 cents per kilowatt hour for the first hour and 20 cents per kilowatt hour for the succeeding hours. The load factor would be over 20 per cent. Theaters use light at a high load factor; they run for short periods, and the load factor is small. Hotels are about 50 per cent., and large dry goods houses 50 per cent., and residences vary all over the line. We have not made any increase since starting in with the Wright demand system. We have not published the fact that we are selling electric light on that basis as yet. We have how-

ever instructed our men to take all new business on that basis. We sell arc lamps at a flat price per week from dusk to midnight. With the exception of that and the power business it is all done on the Wright demand basis. We put our arc light and incandescent light on the same meter. The reading of the demand meter is made at the same time as the reading of the wattmeter. The wattmeter is placed on the wall and the demand meter under it. The latter is graduated in kilowatt hours, the same as the wattmeter.

Mr. Weeks—There have been few discussions before this Association, Mr. President, of greater importance to central station interests than that to which we have just listened. In the cost of our product the relative value of the interest factor has been forcibly and clearly shown, and the necessity for revision of rates or discounts has been ably demonstrated. In my judgment the method employed by Mr. Insull, or a slight modification of it, will soon come into general use. In one respect, however, the practice as stated strikes me of questionable equity if not expediency, and I would like to ask what has been the effect upon your revenue of the lower rates for summer service?

Mr. Insull—We do not know yet. We only put it in operation during the last few weeks.

Mr. Weeks—It seems to me that it is somewhat inequitable to make a lower rate for transient summer service, such as that of the customer who operates a fan but a few weeks, or months at most, in the year, while his rate on account of the interest factor should be higher rather than lower than that for most other classes of service.

Mr. Insull—We have a large by-product that we want to sell, which usually lies idle in the summer, and we endeavor to dispose of it to these casual users.

Mr. Rice—There is only one more point that I wish to speak of that was omitted. The curves alluded to in my paper show the figures during about four years of the recorded plants of England. These figures show plants having outputs between five hundred thousand and four million units. It is interesting to observe that the largest plant shown, the Westminster plant, is only about one quarter as large as the Edison Company of Chicago. The cost here was eight cents per kilowatt hour in 1890, and in 1897 it had dropped to a little over four cents. There are smaller plants, perhaps 100 to 200 kilowatt capacity. Their cost in 1890 was about nine cents a kilowatt hour and in 1896 four cents, and some of the smaller plants, the Portsmouth plant for instance, having a maximum output of only 800,000 units, is down to three and a half cents, whereas with the largest plant in England, its best record is four and a quarter cents per kilowatt hour.

The Ohio Street Railway Association.

At the annual meeting of this association, held in Columbus recently, steps were taken toward extending the membership of the association by admitting the heads of the various departments into the organization. This will make a considerable increase in the membership; hitherto only the recognized heads of the roads could be accepted in the association. With the extended organization there will be meetings with papers that will deal with the advances being made in the roads and how these are attained. The next meeting of the association will be held in Springfield, June 14, 1899. The officers elected are: President, S. L. Nelson, Columbus; vice-president, James F. Flood of Steubenville; secretary and treasurer, Charles Currie of Lima; executive committee: the officers and W. A. Lynch, Canton; T. H. McLean, Toledo, and A. A. Anderson, Youngstown.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY**.

THE DISTRIBUTION OF ELECTRICAL ENERGY IN PARIS.

BY J. LAFFARGUE.

(Continued from page 328.)

The alternating-current distribution is carried out partly by concentric cables and partly by separate cables, laid either in pipes or in sulphated wooden mouldings in concrete subways. Besides supplying the different subscribers, the high-tension network supplies the public lighting of the Avenue de l'Opéra. The transformers, two in number, each of 15 kw., are installed in the upper portion of a kiosque at the corner of the Avenue de l'Opéra and the Rue des Petits Champs. The reception and delivery switchboards for the lamp circuits are placed beneath the transformers. The potential difference at the secondary terminals is 220 volts; the arc lamps are those of Kremenetzki, taking 14 amperes. There are 50 of them, connected five in series, and they are distributed in 10 circuits, of which five are always in use. All the lamp circuits are connected to the kiosque. The distribution is effected by concentric cables, lead-covered and armored, laid direct in the earth; these cables were manufactured by the Société Industrielle des Téléphones. The lamps are mounted on posts 17 ft. high, placed on the two footways of the avenue.

In the course of the year 1896 the municipal works of the Halles generated an output of 1,010,734 kilowatt-hours, of which 478,132 kilowatt-hours were expended in lighting the Halles, 76,147 in the interior of the works, 62,245 in charging the accumulators, and 394,209 in supplying subscribers and for public lighting. The consumption of coal was 8.7 lb. per kilowatt hour generated. The cost price of the kilowatt-hour at the works is 2.45d., non-inclusive of interest and sinking fund. The cost of the public lighting is 3.8d. per kilowatt-hour supplied to the lamp. The cost of a kilowatt hour supplied to subscribers is 3.04d. The selling price of the kilowatt-hour was 9.5d. for continuous current and 9.1d. for alternating current. The number of arc lamps supplied was 245 in the Halles Centrales, 101 on the public thoroughfare, and 196 on the premises of subscribers. The number of incandescent lamps was 743 in the Halles Centrales and 3,479 on the premises of subscribers.

Société du Secteur de la Place Clichy.—This society adopts the five-wire system of distribution by feeders with accumulators at the works and regulators with four dynamos located at the regulating stations within the city. The regulation is carried out also by the aid of boosters arranged in series in the circuit of the feeders at the works. The works comprise three portions, which are quite distinct. In front, and in a line with the Rue des Dames, are the buildings pertaining to the administration; behind these are the machine-room and the boiler-room. The latter contains 12 Noeyer boilers, each supplying 5,500 lbs. of steam per hour, at the pressure of 110 lbs. per square inch. The water used for the boilers passes through Dervaux filters. In the machine-room are located three horizontal Corlies steam-engines, with single cylinders worked non-condensing, yielding 500 HP. Also three vertical compound steam-engines, non-condensing, yielding also 500 HP. at 64 revolutions per minute. These six steam-engines each actuate a continuous-current dynamo having eight poles and an external collector of 340 kw. at 500 volts. These are the machines utilized for the distribution of the electric energy. Along one side are located three Armington horizontal engines with two cylinders, yielding 150 HP., and working at 240 revolutions per minute, each of which actuates by means of belting two bipolar shunt dynamos, yielding 62.5 kw. at 250 volts. Besides these there are two compound engines with variable expansion, yielding 100 HP. at 240 revolutions per

minute, each of which directly actuates a dynamo with external collector, yielding 62.5 kw. at 250 volts. These different machines are utilized in charging accumulators. The works also include two batteries of accumulators, consisting of 250 of the cells of the Société des Métaux, yielding 2,100 ampere-hours, and one battery of 260 Tudor elements, yielding 3,000 ampere-hours. The distribution is wholly effected by lead-covered and armored cables, placed directly in the earth in a layer of fine sand. The junctions of the cables, the tee-joints, and the connections for subscribers are all made in special boxes, hermetically closed, and on a level with the pavement. Some interesting trials have been made at the Clichy sector in the burning of anthracite for the purpose of avoiding smoke. These trials have been made comparatively with Saint-Charles of Charleroi coal burned in smoke-consuming Langer furnaces. The anthracite was burned on Richards firebars. The following gives respectively the consumption per kilowatt-hour.

St. Charles Coal.	Anthracite.
5.5 lbs.	5.1 lbs.
6.1 lbs.	5.5 lbs.
5.8 lbs.	4.65 lbs.

Special trials of St. Charles coal on Richards firebars gave a consumption of 5.8 and 5.9 kilos per kilowatt-hour. Taking anthracite at 27s. 3d. per ton, and St. Charles coal at 22s. 6d., the mean cost respectively would be 0.748d. and 0.71d. per kilowatt-hour. By the use of anthracite, absolute smoke consumption is assured. On July 30, 1897, the number of subscribers supplied was 2,864 taking the equivalent of 152,846 lamps of 10 candles, of which 136,471 were for lighting, 14,622 for motive power, 603 for heating appliances, and 1,150 for public lighting. The yearly return per lamp installed was 10s. The estimated return per lamp was 19s. 6d. for commercial lighting, 6s. 5d. for domestic lighting, 3s. 1d. for motive power, and 11d. for heating. The Clichy sector uses Aron meters; all the other sectors have adopted the Thomson-Houston meters.

Secteur des Champs Elysées.—The Society for the Champs Elysées Sector supplies a large and extended sector, as may be seen on the map; and has therefore adopted the use of alternating currents, with transformers on the premises of subscribers. The central station is installed at Levallois-Perret, on the banks of the Seine, at about 1.5 km. from Paris. It is composed of a large boiler-room, which comprises seven Galloway boilers, each producing 6,600 lbs. of steam per hour, at the pressure of 85 lbs. per square inch. These boilers are furnished with Green's economizers. Within the boiler-room there are two Faroot horizontal steam-engines, with single cylinders and condensers, of 600 HP., working at 60 revolutions per minute; also one similar machine, formed of two twin engines of 300 HP., and one similar engine of 800 HP. One of the three first engines directly actuates a Hillairt alternator, of 400 kw. at 3,000 volts, with a frequency of 40 periods per second, with revolving indicators, and the two others work two Hutin and LeBlanc alternators of the same power; with each machine there is an exciter of 25 kw. at 160 volts. The 800-HP. engine works a Hutin and LeBlanc alternator of 600 kw. at 3,000 volts, of the same frequency, and an exciting continuous-current dynamo of 25 kw. At the present moment a fifth Faroot engine, with a Hutin and LeBlanc alternator, is being installed. There is also to be found at these works a Willans 60 HP. engine, working a continuous-current dynamo of 25 kw., for the supply of electrical energy to a crane located on the banks of the Seine for discharging coal. The alternators are connected in parallel for the various purposes to which they are applied.

The distribution is carried out by Berthoud-Borel concentric cables, lead-covered and armored, laid directly in the earth. The total power actually available is 1,800 kw. At the commencement of

1897 the company possessed 1,723 subscribers, utilizing 127,842 incandescent lamps, 118 arc lamps and 50 motors, equivalent to 220 H.P. We particularly notice that electric motors are beginning to be utilized in the working of lifts. Even in the case of alternating currents there are already a large number of applications in this direction. A few important subscribers desirous of installing electric lighting have made application for the continuous current. We may especially mention a large building in the Avenue des Champs Elysées. The sector is about to establish a special sub-station for the supply of this building. The alternating current is to actuate a rotary transformer, which will supply the continuous current.

(To be continued.)

MIDSUMMER MEETING OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

On Board Steamer North West, Chicago to Duluth.

The meeting was called to order June 11 at 11 A. M. by the President, Mr. F. A. Copeland.

Mr. S. Everett Doane of Marlborough, Mass., then read a paper on "Incandescent Lamps" in which attention was called to the fact that the old theory that the evaporation of carbon and condensation in the bulb of the lamp were the cause of blackening had been exploded, and that the generally accepted theory at present, and which was undoubtedly correct, was that the blackening was truly a chemical effect. After the reading of this paper a vote of thanks was extended to Mr. Doane.

The question-box was then opened by the Secretary and the following question discussed: "What success has been realized in substituting an incandescent lamp in place of wire resistance in direct-current enclosed arc lamp?"

Mr. J. W. Mabbs, of Chicago, said: I have had a little experience in the line suggested. Some two or three years ago I conceived the idea that the resistance in an incandescent lamp was wasting a great deal of energy which ought to be utilized as light, and I had an idea that the resistance that is generally wasted in an incandescent arc lamp could be utilized, and along that line I tried quite a number of experiments by taking several incandescent lamps and putting them in multiple series with the incandescent arc. I had quite a little trouble to get the incandescent lamps to work satisfactorily, owing to their faulty construction, but after a little we got the thing down so that the lamps worked pretty well. The arc lamps worked much better than they did with the metal resistance, and the smaller lamps gave more or less light that we utilized for places where a little aberration in light would not be objectionable, and in that way put the energy formerly thrown away to good use in lighting spaces where a variable light would not be objectionable, and during the two or three years that we have used the incandescent lamps in connection with the arc lamps, in this way, we have been put to less trouble and expense for repairs than when we used the lamps with the metal resistance. By putting about 6 lamps in multiple series of 10 candle power, each one consuming about an ampere, we get very good results.

Mr. Harding—The better service that you obtain from your arcs I presume is due to your having less trouble in maintaining the lamp.

Mr. Mabbs—Yes, sir. I think the main benefit derived is in having the heat from the resistance kept away from the lamp. The insulation, etc., are injured by the resistance in the lamp, and by putting this resistance in incandescent lamps it removes the heat from the arc lamp, and in that way lengthens the life of the arc lamp.

Mr. Wurts—Does the breakage of one of the lamps render them all useless?

Mr. Mabbs—We use a wattage of about four watts

in these lamps, and in that way we figure that five lamps will carry the current necessary to run the arc lamp, and we keep close enough watch of them so that if one burns out we replace it immediately and in that way avoid the loss of the entire lot. If two burn out, however, generally the whole lot goes.

Mr. Wurts—How many have you been operating in that way?

Mr. Mabbs—About 8 or 10. The reason that we have not used more in that way is because the light derived from the incandescent lamps will fluctuate considerably—for instance, a ten candle power lamp ranging from six to twelve candle power, which would be quite objectionable where a continuous light is needed. But for lighting passages, and in fact for all lighting purposes where variation in candle power is unobjectionable, this method of lighting can be used. The method described, however, is impracticable where steady reading or writing is concerned.

Mr. Abadie—What is the maximum distance from the arc lamp at which you can place the incandescent lamps?

Mr. Mabbs—Fifty or sixty feet.

Mr. Kimball—Although I am not a member of your Association, I might say that in Hartford, Conn., they have been making extended experiments in this line and have adopted a special form of series lamp, and are giving it in the form of a bonus to all their customers. It is installed in stairways, entries and places of that description, and it has been very successful. I think they have it in operation now on about 50 lamps. They have been operating that number to decide whether the method is practicable, and if found so they will put it in operation over the whole of their system.

Mr. W. F. Baker, Gas Commissioner of Massachusetts, was next requested to address the Convention, which he did on the subject of "The Mutual Relations of Municipalities and Companies."

At the close of this address, which was greeted with applause, Mr. Hill said: As the steamer is late it will hardly be possible for us to go on shore and still keep our appointment at Sault Ste. Marie. A reception has been prepared for us there, and we have been invited to inspect the new smelting furnaces. We will not reach the "Soo" before 8 o'clock even if we do not stop at Mackinac Island.

Mr. Abadie moved that a committee of three be appointed to determine the matter. This motion was seconded and carried.

The Secretary then suggested telegraphing from Mackinac Island to the "Soo," which suggestion was approved.

Messrs. Meroein, Hill and Abadie were appointed a committee to attend to the matter, after which the meeting adjourned.

A stop of but fifteen minutes was made at Mackinac Island.

At 9 P.M. on the 13th inst. a paper on the subject of "Mechanical Draft" was read by Mr. Cross in the absence of the author of the paper, Mr. Walter B. Snow.

The discussion of this paper was participated in by Messrs. Doherty, Dow and Cross.

This was followed by a paper by Mr. Dow of Midland, Mich., on "Purification of Water."

Mr. A. J. Wurts, of Pittsburg, then spoke at some length on the subject of "Lightning Arresters," after which the meeting adjourned.

On June 14, at 10 A.M., the meeting was called to order by President Copeland in the City Hall at Duluth. Mr. Henry Truelson, Mayor of Duluth, then delivered a welcoming address which was received with applause and responded to in behalf of the Association by President Copeland. After these preliminaries had been gone through with, a paper entitled "Electrical Smelting of Ores," by Mr. W. T. Horry, was read in the absence of the author by Mr. Doherty.

The question-box was then opened and found to

contain the following query: "On an overhead three wire system of direct low tension distribution, does it afford additional protection against lightning to ground the neutral wire at various points throughout the system?"

The President requested Mr. Wurts to give his opinion on the matter.

Mr. Wurts—In my judgment the grounding of this middle wire might, and probably would, protect the generator. But I do not think that the grounding of a wire protects apparatus at any considerable distance from the point at which the wire is grounded. The self-induction of the wire, that is, the resistance of a perfectly straight wire to the passage of disruptive discharges, is so great that the discharge will not travel any considerable distance over the straight wire to get to a perfect ground—it will jump in preference to doing that. I have seen that in practice very often, and have demonstrated the fact in laboratory experiments. I have short-circuited or made a loop of wire—for instance, take a wire running from my position here to the corner of the room and back again, and place a spark gap half way between here and the corner, send disruptive discharges into the wire, and the current will pass across the spark gap rather than go through the wire and back again. That amounts to the same thing as grounded wire, and, as I have said, in preference to traveling the wire the current will jump a considerable spark gap.

Prof. Elisha Gray, by request, then addressed the Association at some length, referring especially to the progress made by electricity since he was a young man. His remarks were listened to with much interest.

Prof. Fujioka of Tokyo, Japan, next addressed the meeting, dwelling especially on the enjoyment of the Lake trip and referring among other things to the use of lightning arresters in Japan. Prof. Fujioka in concluding said: "We are using Morse instruments almost exclusively on telegraph lines in Japan, and we use Western Electric switchboards on all telephone exchanges and Edison and Brush machines in lighting. That shows that the so-called alliance of the United States, Great Britain and Japan is already accomplished as far as electricity is concerned."

This statement was received with rousing applause.

A vote of thanks was then extended to the officers of the North West, and to Mr. James R. Dee for his management of the entertainment at Hancock and Calumet. The mayors and citizens of Duluth and Superior likewise received a vote of thanks, as did Mr. Hill for his untiring efforts in contributing to the success of the trip.

The Convention then adjourned sine die.

The following names additional to those given in our last issue were taken from the steamer's list:

R. N. Adams, P. C. Kelliber, Joseph Ripley, Dr. Darling, Mr. Ferguson, Geo. R. Easterday, Chas. S. Osborne, all of Sault Ste. Marie.

J. Loomis, Cheboygan, Mich.

Willson Howell, Harrison, N. Y.

Mr. Pierce, of Negaunee.

Charles Wigh, Edith Wigh, Hancock.

Edna Lind, Will Caverly, S. E. Doane, W. W. Darley, Chicago.

ELECTRICIANS IN THE WAR.

E. L. Bemiss, superintendent of the Edison Electric Light Company, New Orleans, is co-operating with Col. Eugene Griffin in the organization of the volunteer engineer brigade. He has sent several applications to Colonel Griffin from electricians and others.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Western Electric Company have entered suit in the Circuit Court at Chicago praying for an injunction to restrain the Kellogg Switchboard & Supply Company from infringing on their patent rights relative to improvements in multiple switchboards for telephone exchanges.

At Boston on the 14th inst., in the appeal case of Louis Post et al., complainants, vs. the Beacon Vacuum Pump & Electrical Company et al., the court denied the appellants' petition and motions filed March 7, 1898, and revoked the judgment entered January 18, 1898. The decree of the court below is affirmed with a modification so amending it that the dismissal of the bill shall be without prejudice; appellees recover the costs of this court, and the case is remanded to the Circuit Court for further proceedings accordingly. It was further ordered that a mandate issue forthwith.

In Philadelphia on the 14th inst. Judge Dallas heard argument in the United States Circuit Court upon the plaintiff's motion for preliminary injunctions in the suits of William Pelzer of New York against the Horn & Brannen Manufacturing Company, the Acme Gas Fixture & Art Metal Company, R. W. Giese & Co. and W. J. Buok, Sons & Co., to have the defendants restrained from the making of an alleged infringement on the complainant's patented improvement in electrical fixtures. Decision was reserved. The proceedings are said to be of widespread interest to the trade.

The Tesla Electric Company of New York has brought suit in the Circuit Court at Cincinnati against the Dayton Fan and Motor Company of Dayton, and others, for the alleged infringement of a certain patented improvement in electro-magnetic motors, of which it is claimed Nicola Tesla was the first and original inventor. An injunction and an accounting are asked for.

Warren B. Reed, a citizen of Louisiana, and Brainard Rorison, a citizen of Michigan, have filed suit in New Orleans against the Edison Electric Light Company for alleged infringement of a certain invention patented by complainants. They aver that the General Electric Company of New York controls most of the stock of the Edison Electric Light Company of New Orleans; that said General Electric Company manufactures all kinds of electric appliances; that complainants have invented a meter which greatly economizes the consumption of electricity, and they have protected it by letters patent. They further aver that they showed the meter and its practical workings to the Edison Electric Light people, and soon the latter began to secretly manufacture and put in use a large number of such meters; that later the General Electric Company openly manufactured these meters and sold and put into use thousands and thousands of them, to the great damage of complainants' patent rights, and cutting them off from all profits on said meters thus sold and used. Complainants pray that the court decree that the three wire high efficiency type meter manufactured, sold and used by the General Electric Company are infringements on complainants' patent; that said company be prohibited from manufacturing any more of these meters, and that the matter be referred to a master in chancery to ascertain how many meters have been sold and what profits should have accrued to petitioners.

Richmond, Va.—The Southside Railway & Development Company has asked the Henrico board of supervisors for permission to construct an electric road in Henrico county to connect with the Traction Company's Broad street line in Richmond.

The General Electric Company owed on January 1, 1898, \$1,339,380 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What Is Going On in the Electrical World.

LIGHTING PLANTS.

Bethlehem, Pa.—The town council of the borough of Hellertown has passed an ordinance permitting the Bethlehem Electric Light Company to erect poles and string wires within the corporate limits of that borough for the purpose of operating electric lights and furnishing heat and power by electricity.

Conshohocken, Pa.—The light committee of the town council of the borough of West Conshohocken will receive bids up to July 5 for furnishing electric lights for the borough for the term of five years, 25 candle power, 50 lights with the privilege of more, to burn all night and every night.

Columbus, O.—The Ambos Construction & Electrical Company, which has the contract for constructing the municipal electric light plant, has begun setting the poles. The equipment will require 387 lights and 1,700 poles.

Dalton, Ga.—The finance committee of the city council has been instructed to obtain estimates of the cost of an electric light plant.

Danville, Ill.—The city council has inserted into the annual appropriation ordinance an item of \$30,000 for an electric street lighting plant.

Gaylord, Minn.—At a special election held here on the 8th inst. it was voted to bond the village for the purpose of putting in an electric light plant to cost \$5,000.

Huron, O.—Proposals will be received by the council of this village, at the office of the village clerk, until noon on the 29th inst. for furnishing the necessary materials, machinery, etc., and performing the necessary labor to construct, erect and install the following: 1. Building for power station. 2. Steam plant, consisting of two 80-horse power boilers, two high speed engines, steam fitting, etc. 3. One 60-arc light dynamo, one 1,000 candle power alternating switchboard, pole line and equipment, etc., and everything necessary to make a complete lighting plant. Bids must be addressed to T. W. Derry, clerk, who will furnish specifications, printed forms for bids, etc.

Lansdale, Pa.—The borough council has passed an ordinance authorizing a loan of \$20,000 for the purpose of establishing an electric light plant. The bonds are to bear 3½ per cent. and to run thirty years, exempt from taxation. Bids will be asked for the erection of the plant.

Los Angeles, Cal.—The city council has ordered advertisements printed for bids for an electric lighting plant for the city, complete with the exception of the generating machinery. About 640 lights are called for. The Los Angeles Lighting Company owns the present system.

New Iberia, La.—The electric light plant at this place was totally destroyed by fire on the night of the 5th inst.

Paris, Tex.—The plant of the Paris Gas & Electric Light Company was sold on the 7th inst. to Judge D. H. Scott, who represented one-half of the bondholders as attorney and the other as trustee. The amount bid was \$30,000. The same management will continue and several improvements will be made and probably an electric railway added.

Sea Isle City, N. J.—Proposals will be received at the office of the borough clerk until July 7 for lighting the streets of the borough of Sea Isle City with 80 incandescent lights of 32 cp. for a period of ten years. There is a considerable amount of private lighting in the borough. For specifications apply to A. H. Sickler, Mayor, 516 Minor street, Philadelphia.

Terre Haute, Ind.—The court has issued an order permitting the assignee, John L. Walsh, to sell at private sale the plant of the old Electric Light & Power Company, a rival of Russell Harrison's bankrupt company.

STREET RAILROADS.

Beaumont, Tex.—The city council has repealed the electric street railroad franchise granted to L. P. Featherstone of Galveston.

Dayton, O.—The council has granted a street franchise to the Springfield & Dayton Electric Railway, and work will be pushed in order to have cars running between the two cities by the middle of September. The route selected is about 26 miles long.

Denver, Col.—The board of aldermen has passed the ordinance giving the Denver City Railroad Company permission to change its system from cable to electric power.

Fond du Lac, Wis.—At a recent council meeting L. T. Treleven, A. G. Bechaud and George W. Watson, all wealthy citizens of this city, made a request for a franchise for a street railway. The specification states that the line is to be in course of construction in less than a year. The council adopted a resolution to have the franchise published, in order that the parties interested may submit a bid for the franchise, which is to be sold by the city. A special meeting has been called for June 30 for action on the matter.

Kutztown, Pa.—Albert Schmick, president of the Allentown & Kutztown Traction Company, has secured all right of way for the electric road that is to connect this place and Allentown and work on the construction will begin immediately.

Milwaukee, Wis.—The city attorney is quoted as saying that any additional litigation in the four-cent fare case would only lead to useless expense. The District Court, it will be remembered, decided that the ordinance passed by the council requiring the Milwaukee Electric Railway & Light Company to reduce its car fare to four cents was unconstitutional.

Norwalk, O.—President De Witt of the Sandusky, Milan & Norwalk Electric Railway says that the Pullman Palace Car Company is now constructing for the Norwalk branch of the road the finest passenger car that was ever put on any street car track.

Portland, Me.—Work is being rapidly pushed on the Portland & Yarmouth electric rail road. The foundation for the power house at Falmouth has been laid and work has been begun on constructing a coal wharf.

Southbridge, Mass.—A movement is on foot to form a company made up of Webster and Southbridge capital to build an electric road connecting these two towns. This with the roads now being built would give Southbridge an electric road to Worcester.

St. Albans, Vt.—It is reported that the incorporators of the projected electric road to run from this city to the bay have received word from the Chicago capitalists interested in the enterprise that matters were being satisfactorily arranged and that the prospect for the immediate building of the road is very favorable.

St. Louis.—The Central Traction Company's bond, signed by the Mississippi Valley Trust Company, has been approved by the city council. The bond is for \$250,000 and was given as a guarantee that the provisions of the franchise granted the company by the councils will be faithfully carried out. The franchise is now before the courts, the contention being that under the Julian law it is invalid. The Supreme Court is expected to give a decision on the constitutionality of this law next month.

MANUFACTURING, ETC.

Boston, Mass.—It is stated that the Boston Elevated Railway Company has given a contract to the Walker Company for a generator of a rated capacity of 4,000 horse-power and capable of delivering over 5,000 horse-power for a few hours at a time. It is for use in connection with the surface lines of the company.

Minneapolis, Minn.—To W. H. Dunwoody belongs the distinction of possessing the first and at present only electrically-propelled yacht on Minnetonka lake. The current that drives the motor is obtained from storage batteries placed with the rest of the machinery beneath the floor.

Moon Run, Pa.—The Moon Run Coal Company is having two Morgan-Gardner mining machines installed in its mine. These machines are to be operated by electricity. A compressed-air plant is now in operation at the mine, with electrical haulage, but it is understood that the mine will shortly be operated entirely by electricity.

Newport News, Va.—The steamship Pisa, which sailed from this port for Hamburg, Germany, on the 15th inst., had on board ten large electric cars, manufactured in St. Louis. These are the first American manufactured electric cars to be shipped abroad, and are to be tried as an experiment in competition with German manufactured cars.

New York.—The Goubert Manufacturing Company, 14 and 16 Church street, will furnish, under contract, feed water heaters for the big power station of the Metropolitan Street Railway Company at 96th street and East River. This is said to be the largest single order for feed water heaters ever placed in this or any other country. The first installment consists of 30,000 hp. in six heaters rated at 5,000 hp. each.

COMPANY MATTERS.

Bloomington, Ill.—The \$202,500 realized from the sale of the Bloomington City Railway is to be disbursed as follows: Court costs, \$349.20; D. Funk, trustee, \$500; first mortgage bonds, including \$5,000 fees for Lillard & Williams, attorneys, \$112,215.34; John C. Barron, third mortgage bonds, \$2,523.17; Theodore Kitchen, third mortgage bonds, \$296.84; attorneys' fees for Rowell, Neville & Lindley and Fifer & Barry, third mortgage bonds, \$10,000; Lien holders, 76 third mortgage bonds, \$1,279.92; second mortgage bonds, \$70,335.53; A. E. De Mange, solicitor's fees, \$5,000.

Bridgeport, Conn.—The Canadian Bryant Electric Company has been organized here with a capital of \$5,000 to accommodate Canadian buyers of the products of the Bryant Electric Company. The latter company has already a factory in Montreal.

TRANSMISSION PLANTS.

Buffalo, N. Y.—The motive power of the great milling plant of the Urban Roller Mills is to be changed from steam to electricity generated at Niagara Falls. The electric machinery has been ordered.

New Orleans.—I. Sternfeld, an electrician of the City of Mexico, when here a few days ago, stated that his plan to utilize the water falls of the Monte Alto river

had succeeded and he had been East to purchase the electrical machinery, and had closed a deal with a large manufacturing concern amounting to about \$1,500,000. Mr. Sternfeld stated that "the contract calls for a 6,000 horse-power transmitter, and the current will be carried from the river into Mexico City, a distance of thirty-five miles. The pressure will be 22,000 volts, and it will be carried over three wires into the city. The incline of the Monte Alto river amounts to about 2,000 feet, and there are five of the falls where generators will be placed, four of which will be set in each fall, thus making twenty generators in all. The generators of the electrical current will be run by water power, and a system of signals will be in vogue so that each station will know exactly what the others are doing."

Phoenix, Ariz.—The Arizona Canal and Arizona Improvement companies have been organized and will probably consolidate and form a new company. One of the plans of the men composing the companies is the utilization of the water power, both at the falls on the Arizona canal and at other points, in generating electricity for transmission to Phoenix.

PERSONAL AND MISCELLANEA.

Joseph C. Field, an electrician of wide reputation, died at Chicago of heart disease on the 9th inst. He was seventy-one years old, and had been many years in the employ of the Western Electric Company, retiring from that concern about a year ago on account of ill health. His electrical inventions were numerous and several of them valuable. Mr. Field was born in Syracuse, N. Y., but had been a resident of Chicago for about thirty years. His wife died three years ago, and his only surviving children are Howard Field and Mrs. Cobb.

Dr. A. P. Southwick, the dentist who originated the idea of substituting electricity for hanging, died at his home in Buffalo, N. Y., on the 11th inst. He was locally known as the "Father of Electrocutation." He was born in Ashtabula, Ohio, in 1826. He was deeply interested in science all his life, and at one time managed a large oxy-hydrogen gas plant at Buffalo and invented and patented a process for purifying gas which was highly remunerative to him until the advent of electric lighting.

The electric Jacquard loom invented by Jan Szezanik is to be exhibited at the Paris Exposition for the first time. Before the eyes of the public it will weave silk pocket handkerchiefs. In three minutes the purchaser of such a handkerchief will be photographed by an apparatus in the loom itself, the design plate will be prepared by the same machine, and then it will make a silk handkerchief with the purchaser's likeness woven into it, so that in not more than half an hour from the time when the portrait was taken the buyer will be able to take away with him as a remembrance of the Exhibition a handkerchief with his inwoven portrait, and all for a few francs.

Third Assistant Secretary of State Thomas W. Cridler has been designated to continue the work begun by the late Moses P. Handy as special commissioner of the Paris Exposition. President McKinley in transmitting to Congress a report made on the Exposition by Mr. Cridler, renews his recommendation that a liberal appropriation be immediately granted.

COMMERCIAL PARAGRAPHS.

The Lundell Slow-Speed Electric Motors manufactured by the Sprague Electric Company, 20 Broad street, New York, have probably had as much or more to do with making shafting and belting obsolete than any other electric motor. In this country, in England, and upon the Continent, in Japan, Australia and the far East the Lundell Motor has won enviable standing, for exacting use has demonstrated its advantages. The characteristic feature of the Lundell Slow-Speed Motor is the single field coil which energizes all the magnetic poles, resulting in great simplicity of construction. The magnetic circuits are the shortest possible, and the leakage of the magnetic lines of force is reduced to a minimum, resulting in economy of the field ampere-turns. At the present time there are many thousands of high and medium speed types of the Lundell motor in use and about one thousand of the slow speed, which certainly speaks well for this make of motor.

The Goubert Manufacturing Company, 14 and 16 Church street, New York, has secured from the Metropolitan Street Railway Company of that city the contract for Feed Water Heaters for the mammoth power station being erected at 96th street and East River. The first installment consists of 30,000 hp. in six heaters, horizontal type and rated at 5,000 hp. each. They are to be placed between the low pressure cylinders and the condensers. It is said to be the largest single order for feed water heaters ever placed in this or any other country.

The Warren Electric & Specialty Company, Warren, O., advise us that they are receiving a large number of suggestions of names for their new lamp, and as each suggestion must be accompanied with an order they are correspondingly busy—some of a character to provoke mirth, and which will be published after the contest is closed and prizes awarded.

INCORPORATIONS.

The Natchez Light, Power & Transit Company, Natchez, Miss.—to erect and operate electric plants for lighting and power purposes and the operation of railways. Capital stock, \$100,000.

The Gordon Battery Company, Portland, Me.—to generate and deal in electricity. Capital stock, \$350,000. President, Arthur S. Pinkham; treasurer, Charles E. Lockwood.

The King Electric Company, St. Louis. Capital stock, \$10,000, all paid in. Incorporators: John C. King, Ida A. King and John A. King.

The Central Ohio Gas Company, Lima, O.—to operate in natural and artificial gas and in electricity. Capital stock, \$10,000. Incorporators: H. S. Wheeler, C. H. Gable, J. D. S. Neely, J. W. Easley and A. E. Schlethe.

The Kane's Falls Electric Company, Fort Ann, N. Y. Capital stock, \$25,000. Directors: Eugene L. Ashley and Elizabeth Ashley of Glens Falls, Elmer J. West of Caldwell.

The Providence & Taunton Street Railway Company—to build and operate an electric railway about 16 miles long, beginning where the Taunton line intersects the State line in Seekonk and run through that town, Rehoboth and Dighton to the city square in Taunton, Mass. Capital stock, \$160,000. Directors: J. A. King, clerk, F. E. Perkins, treasurer, Reuben Bovee, N. E. Walker, G. E. Francis, Asa Waterman and Peter A. Corr.

The Boston, Milton & Brockton Street Railroad, Boston, Mass.—to build and operate an electric railway running from the boundary line between Boston and Milton, through Milton, Quincy and Randolph to "West Corners." Capital stock, \$5,000,000. Directors: Bradford Hamilton, clerk, and G. J. Morse, S. A. Hilton, F. W. Archer, A. H. Crossman, F. C. Hinds, J. H. Packard, J. B. L. Bartlett.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 14, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

- 605,503. Electric Railway. Arthur J. Moxham, Lorain, O., assignor to the Johnson Company, same place. Filed Nov. 18, 1897.
- 605,620. Overhead Car or Like Receptacle. Alfred M. Acklin, Pittsburgh, Pa., assignor to Heyl & Patterson, same place. Filed Jan. 15, 1897.
- 605,664. Electric Railway. Charles H. Davis, New York City. Filed Nov. 2, 1897.
- 605,694. Combined Train Arresting and Signaling Mechanism for Electric Railways. Charles H. Davis, New York City. Filed Nov. 9, 1897.
- 605,716. Trolley-Wheel. Alexander F. Humphrey, Allegheny, Pa. Filed Dec. 9, 1897.
- 605,796. Trolley-Role. John N. Prisk, Johnstown, Pa. Filed Feb. 8, 1897.
- 605,814. Electric-Railway System. Henry A. Chase, Boston, Mass. Filed Feb. 7, 1897.
- 605,821. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Filed Dec. 14, 1897.
- 605,885. Brake for Trolley-Cars. Aloysius B. Klingler, Ridley Park, Pa. Filed Feb. 20, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

- 605,198. Incandescent Electric Lamp. Otto H. Michaelson, Charleston, W. Va. Filed July 17, 1897.
- 605,529. Desk-Lamp. William E. Ward, Montclair, N. J. Filed Jan. 2, 1897.
- 605,714. Electric-Arc Lamp. Daniel Higham, Boston, Mass., assignor to Howard H. Higham, Philadelphia, Pa. Filed Oct. 26, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

- 605,525 and 605,526. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 28, 1895, and June 17, 1897.
- 605,665. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed Aug. 6, 1897. Renewed May 18, 1898.
- 605,679. Mounting for Electric Motors. Emil B. W. Reichel and Friedrich W. V. Stein, Berlin, Germany, assignors to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Jan. 27, 1898.
- 605,765. Apparatus for Supplying or Measuring Currents of Electricity. William B. Watson and Thomas Humphreys, Rochdale, England; said Humphreys assignor to said Watson. Filed Dec. 28, 1897.

ELECTRIC ELEVATORS.

- 605,598. Electric Elevator. Hayward Cochran, Chicago, Ill. Filed April 19, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

- 605,575. Carbon Transmitter. Godfrey W. Goss, Kokomo, Ind. Filed April 20, 1897. Renewed Feb. 7, 1898.
- 605,580. Telephone Circuit and Apparatus. Milo G. Kellogg, Chicago, Ill., assignor to the Kellogg Switchboard & Supply Company, same place. Filed March 23, 1897.
- 605,594. Telephone Receiver. Peter C. Burns, Chicago, Ill. Filed Nov. 20, 1897.
- 605,670. Telephone-Switchboard System. Fred C. Hughes, Detroit, Mich. Filed July 3, 1897.
- 605,671. Cord-Weight for Telephone-Switchboards. Fred C. Hughes, Detroit, Mich. Filed Sept. 27, 1897.
- 605,832. Telephone-Transmitter. William E. Sundberg, Worcester, Mass., assignor to Lars M. Petterson and Carl J. Ekstedt, same place, as trustees for the Reliable Electric Manufacturing Company. Filed Sept. 28, 1897.

SIGNALS AND SIGNALING APPARATUS.

- 605,648. Selector Signaling System. Thomas O. Drake, Malta, Ohio. Filed Sept. 17, 1897.
- 605,798. Electric Railway Signal. Charles L. Renrew, East Windsor, Conn. Filed March 2, 1897.

MISCELLANEOUS.

- 605,548. Electric Recording Instrument. Charles L. Jaeger, Maywood, N. J. Filed Aug. 5, 1897.
- 605,661. Insulating Electrodes for Electric Gas-Lighting Burners. Adrian L. Bogart, Jamaica, N. Y., assignor to William B. M. Jordan, New York City. Filed May 5, 1897.
- 605,795. Automatic Electric Fire-Alarm. Herman A. Olson, Quincy, Mass. Filed June 17, 1897.

TELEPHONE AND TELEGRAPH.

A special committee of the council of Terre Haute, Ind., has reported in favor of granting a franchise to operate in that city to the People's Telephone Company.

The Eastern Wisconsin Telephone Company has been granted a franchise to enter Fond du Lac. Lines of this company are now operating in Sheboygan, Manitowish, Calumet and Fond du Lac counties.

At Columbia, Tenn., recently the board of mayor and aldermen reconsidered their action in regard to refusing a franchise to the American Telephone & Telegraph Company of Tennessee, and by a unanimous vote granted the franchise.

The Southwestern Telegraph & Telephone Company has been certified to the Secretary of State at Albany, N. Y., that it had increased its capital stock from \$4,000,000 to \$5,000,000. The liabilities of the company are \$131,000.

H. A. Helvin of Columbia, Tenn., and associates have been granted a franchise to operate a telephone exchange in Chattanooga, Tenn. The ordinance, however, is hedged about with rigid restrictions, and it is doubtful whether Mr. Helvin will consent to operate under its provisions. He is allowed ninety days to decide.

Frank L. Wood has been appointed receiver of the New York State Telephone Company of Syracuse. The receivership is the result of an action brought by Frank Sumney to set aside a bill of sale and transfer of the property to the Automatic Service Company of Buffalo.

The Erie Telegraph & Telephone Company held its annual meeting in New York on the 14th inst., and elected the following officers: President, Charles J. Glidden; secretary, George B. Perham; treasurer, Charles A. Grant; general manager, James P. McKinstry. The Southwestern Telegraph & Telephone Company elected the same officers.

The Baldwinsville, N. Y., Telephone Company has asked the court to grant a peremptory mandamus directing the Central New York Telephone & Telegraph Company to furnish it a service so that it can transmit messages to Syracuse which it has refused to do. It is claimed that the company is a common carrier and bound to furnish service to the entire public and that under the telephone law rival telephone corporations must be treated the same as individuals.

Judge Lacombe, in the United States Circuit Court at New York, has signed an order discontinuing the suit of the United States of America against La Compagnie Francaise des Cables Telegraphiques. This is done by mutual consent of and without cost to either party to the suit. The suit was brought to prevent the cable company from landing on American soil.

A resolution passed by the city council of Des Moines, Ia., orders the Iowa Telephone Company to cease setting poles, stringing wires, laying cables, or in any manner using the streets and alleys of Des Moines for the operation of telephones; also instructs the city solicitor to notify that company that if the ordinance is not complied with he will immediately take the matter into court. Council holds that the company has no right to use the streets, its franchise having expired over a year ago.

The law governing the operation of telephone lines under the War Revenue bill, now in force, is as follows: "It shall be the duty of every person, firm or corporation owning or operating any telephone line or lines to make within the first fifteen days of each month a sworn statement to the Collector of Internal Revenue in each of their respective districts, stating the number of messages or conversations transmitted over their respective lines during the preceding month for which a charge of 15 cents or more was imposed, and for each of such messages or conversations the said person, firm or corporation shall pay a tax of one cent; provided, that only one payment of said tax shall be required, notwithstanding the lines of one or more persons, firms or corporations shall be used for the transmission of each of said messages or conversations."

New Companies Incorporated.

The United Telephone Company, Swanwick, Ill. Capital stock, \$500. Incorporators: John I. Higgs, Philip Fearnson and Matt Robb.

The Mountain Home & West Plains Telephone Company, Little Rock, Ark. Capital stock, \$5,000. Incorporators: O. W. Brown, president; N. H. Dyer, B. E. Massey, B. O. Paul, W. C. Eastman and R. C. Love.

The Lawrence Telephone Company of Ashland, Ky., has filed articles with the Secretary of State increasing its capital stock from \$12,000 to \$24,000.

The New York & Long Island Telegraph Company has been certified to an increase of capital from \$5,000 to \$30,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; Inc., income; imp., improvement; pd., paid; pfd., preferred; mig., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par.	Authorized.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—June 20:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q., Feb. '98.	142 1/2	145
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, '97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000			
Allentown, Pa.—June 20:						
Allentown & Lehigh Val. Trac. Co.	100	4,000,000	1,500,000		15	
Bridgeport, Conn.—June 20:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60
Baltimore, Md.—June 20:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	72	73
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23 1/4	23 1/2
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2
Boston, Mass.—June 20:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97	10	15
North Shore Traction Co.	100	4,000,000	4,000,000		72	76
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	83	83 1/2
West End Street Ry. Co.	50	10,000,000	9,085,000	1 % S., Oct., '97.	102	104
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	64	65
Boston Elevated R. R.	100	10,000,000				
Brooklyn, N. Y.—June 20:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	20 1/2	50 1/2
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000		50 1/2	
Brooklyn Heights Railroad	100	200,000	200,000		211	218
Brooklyn City RR. guar.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	211	218
Brooklyn Queens Co. & Sub. RR.	100	2,000,000	2,000,000		200	205
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1 % Oct. 1, '97.	47	48
Kings County Elevated	100	4,750,000	4,750,000		37 1/2	
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 28, '97	74	80
Nassau Electric Railroad	50	6,000,000	6,000,000			
Atlantic Avenue Railroad	50	2,000,000	2,000,000			
Brooklyn B. & W. E. Railroad	100	1,000,000	1,000,000			
Buffalo, N. Y.—June 20:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000		58	60
Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80 1/2	82
Columbus, O.—June 20:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000			
Charleston, S. C.—June 20:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000			
Chicago, Ill.—June 20:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, '97.	250	260
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800		13	14 1/2
Lake Street Elevated RR.	100	10,000,000	10,000,000		8	
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000			
Met. West Side El. const. stk.	100	15,000,000	2,500,000			
North Chicago Street RR.	100	10,000,000	6,600,000	8 % Q., Jan., '98.	206	208
North Chicago City RR.	100	500,000	249,900			
South Chicago City Railway	100	2,000,000	1,603,200			
West Chicago St. RR. Co.	100	20,000,000	13,189,000	1 1/2 % Q., Feb. '98	90 1/4	90 1/2
Chicago West Div. Ry. guar.	100	1,250,000	1,250,000			
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.		
Cincinnati, Ohio.—June 20:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000		20	
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2 1/2 % S., Feb., '98.	75	
Cincinnati, Newport & Cov. St. Ry.	50	4,000,000	3,500,000		28	25
Cincinnati Street Ry. Co.	100	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	113
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.		
Cleveland, Ohio.—June 20:						
Akron, Red. & Cleve. Elec. Ry.	100	1,000,000	1,000,000	1/2 % Jan., '98.	39	40
Cleveland City Ry.	100	8,000,000	7,600,000	1/2 % Q., Oct., '97.	55	60
Cleveland Electric Ry.	100	12,000,000	12,000,000	1/2 % Q., Oct., '97.	50	53
Detroit, Mich.—June 20:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000		100 1/2	
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	
Rapid Railway Co.	100	250,000	250,000			100
Detroit Electric Railway	100	1,000,000	1,000,000			
Wyandotte & Detroit River Ry.	100	250,000	200,000		100	110
Dayton, O.—June 20:						
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98	140	145
People's Street Railway	100	1,100,000			100	

PASSENGER RAILWAYS.

NAME.	Par.	Authorized.	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—June 20:						
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000	8 % S., Jan., '98.	140	
Hartford & West Hartford RR.	100	1,000,000	247,000			
Holyoke Mass.—June 20:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	200	205
Hoboken, N. J.—June 20:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1897.	70	
Indianapolis, Ind.—June 20:						
Citizens' Passenger Ry.	100	5,000,000	5,000,000		28 1/2	
Lancaster, Pa.—June 20:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000			
Lancaster & Col. Electric Ry.	100	87,500				
West End Street Railway	100					
Louisville, Ky.—June 20:						
Louisville Ry. com.	100	4,000,000	3,500,000	1 1/2 % S., Oct., '97.	81	89
Louisville Ry. 5 % pfd.	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	96	100
Minneapolis, Minn.—June 20:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000		14	20
Twin City Rapid Transit 7 % pfd.	100	8,000,000	1,714,200	1 1/2 % Jan., '98.		100
Montreal, Canada.—June 20:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	4 % S., M. & N.	237	237 1/2
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	98	98 1/2
Memphis, Tenn.—June 20:						
Memphis Street Railway Co.	100	500,000	500,000		15	
New Haven, Conn.—June 20:						
Fair Haven & Westville RR.	25	1,500,000	900,000	1 % S., Sept., '97.	60	
New Haven Street Railway Co.	100	1,250,000	1,000,000	2 % S., July '96.	60	80
New Haven & Centerville	100	700,000	300,000			
Winchester Avenue RR.	25	1,000,000	600,000		40	42
New Orleans, La.—June 20:						
Canal & Claiborne RR. Co.	40	240,000	240,000	1 % S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	123 1/2	128
New Orleans Traction Co. com.	100	5,000,000	5,000,000		1	3
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000		7	19
Orleans City RR. guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	81	83
New Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	88
Orleans Railroad	50	500,000	185,000	1 1/2 % S., Jan., '94.	16	17
St. Charles Street Railway	50	1,000,000	1,000,000	1 1/2 % S., Jan., '98.	83 1/2	84 1/2
New York—June 20:						
Central Crostown RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	240	
Christopher & 10th St. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	175	195
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000	1 1/2 % Q., Jan., '98.	162	172 1/2
Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	1/2 % A., July, '97.	2	88 1/2
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	2	185
Gen. Park N. E. Rivers RR. guar.	100	1,400,000	1,400,000	2 1/2 % Q., Jan., '98.	120	325
Eight Avenue RR.	100	1,000,000	1,000,000		330	36 1/2
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 1/2 % Q., Feb., '98	170	180
Ninth Avenue RR. guar.	100	800,000	800,000		200	210
Sixth Avenue RR. guar.	100	2,000,000	2,000,000		320	
Twenty-third St. R. R. Co. guar.	100	600,000	1,862,000	2 % Q., Jan., '98.	170	17 1/2
Second Avenue RR.	100	2,500,000	10,000,000	2 % Q., Feb., '98.	174	176
Third Avenue RR.	100	2,500,000	2,500,000		60	65
42d St., Manhattan & St. Nicholas Av.	100	2,000,000	2,000,000		175	200
*Union (Huckleberry) Ry.	100	2,000,000				
Newark, N. J.—June 20:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000		47	48
Newark Passenger Ry.	100	6,000,000	6,000,000		180	190
Rapid Transit Street Ry.	100	504,000	504,000	1 1/2 % A.		
Pittsburg, Pa.—June 20:						
Allegheny Traction Co.	50	500,000	500,000			
Consolidated Traction Co. com.	50	15,000,000	15,000,000	2 % Jan., '95.	17 1/2	15
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 % May, '97.	49	41 1/2
Central Traction Co.	50	1,500,000	900,000			
Citizens' Traction Co.	50	8,000,000	13,000,000	6 % A.	107 1/2	
Duquesne Traction Co.	50	8,000,000	13,000,000	8 % A.		
Pittsburg Traction Co.	50	2,500,000	1,900,000	3 % Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 1/2 % Jan., '98	24	24 1/2
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,339	2 % Aug., '95.		
Pittsburgh & Birmingham Trac. Ry.	25	8,000,000	8,000,000	1 1/2 % Jan., '96.	16 1/2	19
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, '97.		
Second Avenue Traction Co. com.	50	4,000,000	14,000,000			
Suburban Rapid Transit Co.	50	800,000	200,000			

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore
 & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway
 and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau system.
 h 80 % per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.;
 \$250,100 of stock owned by North Chicago Street Railroad Company.
 i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and
 West Chicago Street Railroad Tunnel Company.
 j 85 % per annum paid on outstanding capital as rental by lessee—North Chicago Street
 Railroad Company; \$625,100 of stock owned by West Chicago Street Railroad Company.
 k Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,
 000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 8 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
 f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
 g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
 h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at \$215,000 per annum.
 i Leased to Metropolitan Street Railway for 18 % on stock.
 j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
 k Leased to Metropolitan Street Railway for \$145,000 per annum.
 l Leased to Metropolitan Street Railway for 18 percent on capital stock.
 m Controlled by Third Avenue Railroad by purchase.
 n Dividends of 1 1/2 % yearly guaranteed by Consolidated Traction Company.
 o Controls by lease the Allegheny, Cent., Citizens, Duquesne, Fort Pitt and Pitts' Trac. Co.
 p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
 q Leased to Fort Pitt Traction Company for 6 % on \$8,000,000 capital stock.
 r Leased to Consolidated Traction Company for 4 % on capital stock after October,
 s Leased to Consolidated Traction Company for 1 % on capital stock after October.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authors'd	Issued.						Authors'd	Issued.			
New Bedford Mass.—June 20:							Boston, Mass.—June 20:						
Union Street Railway Co.....	100	\$250,000	\$250,000	2 1/2 %	Feb. '98.	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4 1/2 % Q.	Jan., '98.	27 1/2
Northampton, Mass.—June 20:							New York.—June 20:						
Northampton Street Ry.....	100	800,000	225,000	4 1/2 % A.	Jan., '98.	165 175	*Erie Telegraph & Telephone Co.....	100	.....	1 1/2 % Q.	Jan. '98.	68 69	
Omaha, Neb.—June 20:							Philadelphia.—June 20:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	.....	25	Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	1,770,000	2 1/2 %	Dec. '97.	14 1/2
Paterson, N. J.—June 20:							Hestonville, Man. & Fairmount.....						
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	.....	85 86	50	1,966,100	1,966,100	2 1/2 %	July 15, '97.	43 1/2	
Providence, R. I.—June 20:							Hestonville, Man. & Fairmount 6 % pfd.						
United Traction & Electric Co.....	100	8,000,000	8,000,000	3/4 %	Jan. '98.	59 1/2 63	50	533,900	533,900	3 1/2 % S.	Jan. 10, '98.	65 1/2	
Philadelphia.—June 20:							aFairmount Pk. & Had. Pass. Ry.						
Fairmount Park Trans. Co. \$20 pd.	50	2,000,000	1,770,000	2 1/2 %	Dec. '97.	14 1/2	50	300,000	800,000	8 1/2 %	Feb. 1, '98.	65 1/2	
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2 1/2 %	July 15, '97.	43 1/2	50	30,000,000	29,930,450	.....	.....	17 1/2	
Hestonville, Man. & Fairmount 6 % pfd.	50	533,900	533,900	3 1/2 % S.	Jan. 10, '98.	65 1/2	50	500,000	8,297,920	.....	.....	71 1/2	
aFairmount Pk. & Had. Pass. Ry.	50	300,000	800,000	8 1/2 %	Feb. 1, '98.	65 1/2	50	1,000,000	192,500	\$3 share Q.	.....	275	
Union Traction Co. \$12 1/2 pd.	50	30,000,000	29,930,450	.....	.....	17 1/2	50	1,000,000	1,875,000	\$14 share A—Apr. '97	8 1/2	.....
aElectric Traction Co.....	50	.....	8,297,920	.....	.....	71 1/2	50	1,000,000	1,000,000	A. & O.	.....	89	
aCitizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	.....	275	50	1,000,000	771,076	\$9 share A. Mar. '97	265	.....
aFrankford & Southwark Pass. R.	50	.....	1,875,000	\$14 share A—Apr. '97	8 1/2	.....	50	10,000,000	16,000,000	3 1/2 % A., April, '97.	185	.....
aLehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	.....	89	50	1,500,000	1,572,800	\$5.25 share—1898.	138 1/2	.....
aLombard & South Street Ry.....	25	.....	1,000,000	A. & O.	.....	90 1/2	50	500,000	150,000	3 1/2 % Jan., 1898.	.....	.....
aSecond & Third Streets Ry.....	50	1,060,000	771,076	\$9 share A. Mar. '97	265	.....	50	1,500,000	740,000	.....	.....	.....
aPeople's Traction Co.....	50	10,000,000	16,000,000	3 1/2 % A., April, '97.	185	.....	50	750,000	127,402	.....	.....	.....
aGermantown Passenger Ry.....	50	1,500,000	1,572,800	\$5.25 share—1898.	138 1/2	.....	50	30,000,000	20,000,000	4 1/2 % S—Oct. 1, '97.	84 1/2	84 1/2	
aGreen & Coates Passenger Ry.....	50	500,000	150,000	3 1/2 % Jan., 1898.	.....	.....	50	1,000,000	140,000	6 1/2 % A—Mar. '97.	.....	.....
aPeople's Passenger Ry.....com.	25	1,500,000	740,000	.....	.....	.....	50	1,000,000	580,000	\$6 share—July, '97.	142 1/2	.....
aPeople's Passenger Ry..... pfd.	25	750,000	127,402	.....	.....	.....	50	1,000,000	600,000	.....	.....	.....
aPhiladelphia Traction Co.....	50	30,000,000	20,000,000	4 1/2 % S—Oct. 1, '97.	84 1/2	84 1/2	50	1,000,000	147,500	\$7.50 share July '97	175	.....
aCatherine & Bainbridge St.....	50	.....	140,000	6 1/2 % A—Mar. '97.	.....	.....	50	1,000,000	298,650	\$8.50 share July '97	90 1/2	.....
aContinental Pass. Ry. guar.	50	1,000,000	580,000	\$6 share—July, '97.	142 1/2	.....	50	1,000,000	142,000	\$12 share, July, '97	291	300	
Empire Passenger Ry. Co.....	50	600,000	600,000	.....	.....	.....	50	750,000	200,000	\$2 share July, '97.	.....	.....
aPhiladelphia City Pass. Ry.....	50	1,000,000	147,500	\$7.50 share July '97	175	.....	50	.....	125,000	1 1/2 % S., July, '97.	157 1/2	.....
aPhiladelphia & Gray's Ry. R.R.	50	1,000,000	298,650	\$8.50 share July '97	90 1/2	.....	50	1,000,000	335,000	\$11 sh. A., July, '97	280 1/2	.....
aRidge Avenue Passenger Ry.....	50	750,000	142,000	\$12 share, July, '97	291	300	50	1,500,000	900,000	\$9.50 sh. A., July '97	234	.....
aPhiladelphia & Darby Ry. guar.	50	.....	200,000	\$2 share July, '97.	.....	.....	50	750,000	175,000	\$10 share, July '97	234	235	
a17th & 19th Sts. Pass. Ry. guar.	50	.....	125,000	1 1/2 % S., July, '97.	157 1/2	.....	Rochester, N. Y.—June 20:						
aThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	335,000	\$11 sh. A., July, '97	280 1/2	.....	Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16 18	.....
aUnion Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. A., July '97	234	.....	Reading, Pa.—June 20:						
aWest Philadelphia Pass. Ry.....	50	750,000	175,000	\$10 share, July '97	234	235	aReading Traction Co.....	.....	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	.....
Rochester, N. Y.—June 20:							St. Louis Mo.—June 20:						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	16 18	.....	Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	.....	.....
Reading, Pa.—June 20:							Jefferson Avenue Ry. Co.....						
aReading Traction Co.....	.....	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	.....	50	400,000	400,000	2 1/2 %	Dec., 1898.	.....	.....
aCity Passenger Ry.....	50	350,000	350,000	Jan., '98.	112	.....	100	2,500,000	2,400,000	1 1/2 %	Jan., '98.	122 1/2	125
aEast Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	.....	.....	2,500,000	2,479,000	1 1/2 %	Jan., '98.	.....	.....
St. Louis Mo.—June 20:							Case Avenue & Fair Grounds.....						
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	.....	.....	.....	2,500,000	2,500,000	.....	.....	.....	.....
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2 1/2 %	Dec., 1898.	.....	100	2,000,000	1,500,000	1 1/2 %	Oct., '98.	90	110
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2 %	Jan., '98.	122 1/2 125	100	2,000,000	2,000,000	2 1/2 %	Jan., '98.	95	105
National Railway Co.....	.....	2,500,000	2,479,000	1 1/2 %	Jan., '98.	.....	100	2,400,000	2,300,000	1 1/2 %	Jan., '98.	170	172 1/2
Case Avenue & Fair Grounds.....	.....	2,500,000	2,500,000	.....	.....	.....	50	1,000,000	800,000	50c.,	Dec., '98.	.....	.....
Citizens' RR.....	100	2,000,000	1,500,000	1 1/2 %	Oct., '98.	90	50	500,000	500,000	.....	.....	57	60
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2 %	Jan., '98.	95	100	1,000,000	1,000,000	1 1/2 %	Jan., '98.	108	110
Missouri RR.....	50	2,400,000	2,300,000	1 1/2 %	Jan., '98.	170	100	2,500,000	2,500,000	.....	.....	55	56
People's RR. Co.....	50	1,000,000	800,000	50c.,	Dec., '98.	172 1/2	100	4,000,000	4,000,000	3 1/2 % A.,	July, '98.	175	.....
Southern Electric Ry.....com.	50	500,000	500,000	.....	.....	.....	San Francisco, Cal.—June:						
Southern Electric Ry..... 6 % pref.	100	1,000,000	1,000,000	1 1/2 %	Jan., '98.	108 110	California St. Cable R.R.....	100	1,000,000	600,000	50c. monthly.	110	.....
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	.....	.....	.....	Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '98.	40	50
Union Depot RR.....	100	4,000,000	4,000,000	3 1/2 % A.,	July, '98.	175	Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2	58
San Francisco, Cal.—June:							Scranton, Pa.—June 20:						
California St. Cable R.R.....	100	1,000,000	600,000	50c. monthly.	110	.....	Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10	12
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '98.	40 50	.....	aScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	.....
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/2 58	.....	aScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	.....	.....
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	8 1/2	.....	Springfield Ill.—June 20:						
Scranton, Pa.—June 20:							Springfield Consolidated Ry.....						
Scranton Railway Co.....	50	6,000,000	2,500,000	.....	10 12	.....	100	750,000	750,000	.....	11	.....	.....
aScranton & Carbondale Trac. Co.	100	500,000	500,000	.....	18	.....	Springfield O.—June 20:						
aScranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	.....	.....	Springfield Street Ry.....	100	1,000,000	1,000,000	.....	2	.....
Springfield Ill.—June 20:							Springfield, Mass.—June 20:						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	11	.....	Springfield Street Ry.....	100	1,200,000	1,166,700	8 1/2 % A.	206 210	.....
Springfield O.—June 20:							Toronto Canada.—June 20:						
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	2	.....	Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	98	98 1/2
Springfield, Mass.—June 20:							Washington, D. C.—June 20:						
Springfield Street Ry.....	100	1,200,000	1,166,700	8 1/2 % A.	206 210	.....	Belt Ry. Co.....	50	500,000	500,000	.....	.....	.....
Toronto Canada.—June 20:							Capital Traction Co.....						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2 % S.	98	98 1/2	100	12,000,000	12,000,000	65c. per sh. Oct. '97.	72 1/2	78 1/2	
Montreal Street Railway Co.....	.....	4,000,000	4,000,000	4 1/2 % S.	257	257 1/2	50	400,000	400,000	6 1/2 % A.	75	78	
Washington, D. C.—June 20:							Eckington & Soldiers' Home Ry.....						
Belt Ry. Co.....	50	500,000	500,000	.....	.....	.....	50	707,000	652,000	.....	8	.....
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. '97.	72 1/2	78 1/2	50	200,000	200,000	.....	.....	.....
Columbia Ry. Co.....	50	400,000	400,000	6 1/2 % A.	75	78	50	1,000,000	458,900	2 1/2 % Q.	124	125	
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	8	.....	Worcester, Mass.—June 20:						
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	.....	.....	*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	15	17
Metropolitan RR. Co.....	50	1,000,000	458,900	2 1/2 % Q.	124	125	*Worcester Traction Co. 6 % pfd.	100	2,000,000	2,000,000	8 1/2 % S., Feb., '98.	95	96
Worcester, Mass.—June 20:							Worcester & Suburban Street Ry.....						
*Worcester Traction Co.....	100	8,000,000	8,000,000	.....	15 17	.....	100	550,000	542,500	4 1/2 % S., 1897.	84	.....
*Worcester Traction Co. 6 % pfd.	100	2,000,000	2,000,000	8 1/2 % S., Feb., '98.	95	96	Wilkesbarre, Pa.—June 20:						
Worcester & Suburban Street Ry.....	100	550,000	542,500	4 1/2 % S., 1897.	84	.....	Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 1/2 %	Jan., '97.	24 29
Wilkesbarre, Pa.—June 20:							Philadelphia, Pa.—June 20:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 1/2 %	Jan., '97.	24 29	Acetylene L. H. & P. Co.....\$35 pd.	50	1,000,000	.....	.....	.....	.....
Boston Mass.—June 20:							Electro Pneumatic Trans. Co.....						
American Electric Heating Co.....	50	10,000,000	.....	.....	.....	.....	10	1,500,000	.....	.....	.....	.....	.....
Street Ry. & Ill'g Properties... pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '98	80	85	50	10,000,000	.....	.....	.....	74 1/2	.....
United Electric Securities Co... pfd.	100	.....	.....	3 1/2 % Feb., '98.	80	85	100	8,500,000	.....	.....	.....	21	22
New York.—June 20:							Welsbach Commercial Co.....com.						
Consolidated Electric Storage Co...	.....	.....	.....	.....	20	22	100	8,500,000	.....	.....	.....	74	75
Edison European.....	.....	.....	.....	.....	1	8	100	500,000	.....	2 1/2 % Q.	.....	74	75
Safety Car Heating & Lighting Co...	100	.....	.....	.....	80	88	.....	.....	.....	

* Unlisted. † Paid in. ‡ Full paid. § Outstanding. ¶ Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Leased to Electric Traction Company.
 g Leased to People's Passenger Railway at \$5 per share.
 h Majority of stock owned by People's Traction Company.
 i Leased to Union Traction Company.
 j Lease transferred to Union Traction Company.
 k Leased to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 l Dividend of 10 % guaranteed by Reading Traction Company.
 m Dividend of 6 % guaranteed by Reading Traction Company.
 n Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.—June 20:						Boston, Mass.—June 20:					
Fort Wayne Electric Co.....	.....	.....	.....	.....	.....	American Electric Heating Co.....	50	10,000,000	.....	.....	.....
Pt. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	.....	Street Ry. & Illu'g Properties..... pfd	100	4,500,000	1,248,700	\$3 per sh. Feb. 1, '98	80 85
General Electric Co. (of Canada).....	100	40,000,000	30,460,000	2 1/2 % Q., Aug., 1898.	37 1/2 37 1/2	United Electric Securities Co. pfd.	100	.....	.....	2 1/2 % Feb., '98.	80 ..
General Electric Co. (of Canada)..... pfd.	100	10,000,000	4,252,000	3 1/2 % S., July, '98.	92 95	New York.—June 20:					
T. H. Elec. Co. T. Secur. Series D.	.....	.....	.....	.....	.....	Consolidated Electric Storage Co.....	.....	.....	.....	.....	20 22
Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	.....	Edison European.....	.....	.....	.....	.....	1 8
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1 1/2 % Q., Feb., '98.	23 24	Safety Car Heating & Lighting Co.....	100	.....	.....	.....	94 98
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,196,126	.....	54 55	Worthington Pump Co.....	100	5,500,000	5,500,000	.....	80 88 1/2
New York.—June 20:						Worthington Pump Co..... pfd	100	2,000,000	2,000,000	7 1/2 %	90 91 1/2
Edison Elec. Illu'g Co., New York..	100	10,000,000	7,988,000	.....	125 130	Philadelphia, Pa.—June 20:					
*Edison Elec. Illu'g Co., Brooklyn..	100	4,000,000	3,750,000	1 1/2 % Oct., '97.	10 18	Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2 ..
Edison Ore Milling Co.....	100	.....	.....	.....	21 25	*Electric Storage Battery Co. com.	100	8,500,000	.....	.....	22 28
Edison Electric Storage Co.....	.....	.....	.....	.....	8 1/2 8 1/2	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	.....	24 1/

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.	NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.						Authorized.	Issued.				
Albany, N. Y.							New Orleans La.						
Date of Quotation—June 20, 1898							Date of Quotation—June 20, 1898.						
The Albany Ry. 1st mtg. 6s.		\$29,000	1905				Canal & Claiborne RR. 1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	182	....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1930	J. & J.	*111		Crescent City RR. 1st mtg. 6s.		50,000	1899	M. & N.	191	....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111		Crescent City RR. Cons. mtg. 5s.	5,000,000	8,000,000	1943	J. & J.	75%	77
Waterfront Turnpike & RR. 1st mtg. 6s.	850,000	850,000	1919	M. & N.	*117		New Orleans City RR. 1st mtg. 6s.	416,500	399,000	1903	J. & D.	108	111
Waterfront Turnpike & RR. 2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115%		N. Orl's City & Lake RR. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98%	99%
Troy City Railway Co. 1st 5s					*105	105%	N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	110	....
†Interest guar. by Albany Ry. Co. †Principal and interest guar. by Albany Ry. Co.							Orleans Railroad Co. Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	9%	100
							St. Charles St. RR. Co. 1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	....
							*\$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. *\$90,000 outstanding.						
Baltimore Md.							New York.						
Date of Quotation—June 20, 1898							Date of Quotation—June 20, 1898.						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116	Atlantic Ave. (Brooklyn) Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115		Atlantic Av. (Brooklyn) 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	....
Baltimore Trac. Co. Ext'n. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102%	108	Bro'dway Av. (Brooklyn) Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	109
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114%	115	Bro'dway & 7th Ave. 1st cons. mtg. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120%
Bal. Trac. Co. Coll. Trust. 1st mtg. g. 5s.	750,000		1900	J. & J.	101%		Bro'dway & 7th Ave. 1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Baltimore Traction Co. Convertible 5s.	800,000		1906	N. & M.	103%		Bro'dway & 7th Ave. 2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Central Pass. Ry. Co. 1st mtg. 6s.	96,000	117,000	1912	J. & J.	110		Bro'dway Surface. 1st mtg. 5s.	1,125,000	1,125,000	1924		114	116
Central Pass. Ry. Co. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	113	116	Bro'dway Surface. 2d mtg. 5s.	1,000,000	1,000,000	1905		106	106
City & Suburban Ry. 1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113%	114%	Brooklyn City RR. Co. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110		Brooklyn City & Newtown. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114%	115%
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119%	Brooklyn Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. *\$151,000 in escrow to retire 1st mtg. bds.							Brooklyn Heights RR. 1st mtg. 5s.	250,000	250,000	1941	A. & O.	99	100
							Brooklyn, Q's Co. & Sub'n. 1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	105	108
							Brooklyn, Q's Co. & Sub'n. 1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	85	90
							Brooklyn Rapid Transit. gold 5s.	7,000,000	5,181,000	1945		99%	....
							Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900		101	104
							Cent Pk. N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111%
							Central Crostown RR. 1st mtg. 6s.	250,000	250,000	1922	M. & N.	118%	122
							Coney Island & Brooklyn RR. 1st mtg. 5s.	300,000	800,000	1903	J. & J.	103	105
							D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	114%	116%
							Dry Dock, E. Bd'y & Bat'y R. scrip 5%	1,100,000	1,100,000	1914	F. & A.	100	*108
							Elgin Av. RR. Co. Cert. indebt. 6%	1,000,000	1,000,000	1914	F. & A.	104	....
							42d St. Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
							42d St. Man. & St. N. Av. 2d mtg. Inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	93
							Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	117%	....
							Metropolitan St Ry Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	112%	118%
							Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110%
							Second Avenue Ry. Deb. 5s.	300,000	800,000	1909	J. & J.	105	108
							Steinway Ry. (L. I.) 1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
							South Ferry RR. Co. 1st mtg. 5s.	350,000	850,000	1919		107	....
							Third Avenue RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	122%	123
							Twenty-third Street Ry. 1st mtg. 6s.			1909	J. & J.	....	....
							Twenty-third Street Ry. Deb. 5s.	150,000	150,000	1906	J. & J.	108	108
							Union (Huckleberry) Ry. 1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	112	115
							Westchester Electric RR. 1st mtg. 5s.	500,000	500,000	1943	J. & J.	108	....
							*\$1,035,000 in escrow to retire gen. mtg. bonds. *\$4,850,000 in escrow to retire maturing obligations. *\$552,000 in escrow to retire 1st and 2d mtg. bonds. †In treasury, \$80,000. †Guar. by Union Ry. Co.						
							Toronto Canada.						
							Date of Quotation—June 20, 1898						
							Montreal St. Ry. 1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
							Toronto St. Ry. 1st mtg. g. 4%	4,550,000	2,200,000	1921	M. & S.	....	....
							*\$85,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.						
							Philadelphia.						
							Date of Quotation—June 20, 1898						
							Continental Pass. Ry. 1st mtg. 6s.	850,000	810,000	1909	J. & J.	....	....
							Empire Pass. Ry. 1st mtg. 7s.	800,000	200,000	1900	J. & J.	....	....
							Greene & Coates St. Ry. 1st mtg. 6s.	100,000	100,000	1898	J. & J.	....	....
							Lombard & So. St. Pass. Ry. 1st mtg. 6s.	150,000		1901		....	....
							People's Pass. Ry. 1st mtg. 7s.	250,000	250,000	1905	J. & J.	....	....
							People's Pass. Ry. 2d mtg. 5s.	500,000	458,000	1911	J. & J.	....	....
							People's Pass. Ry. Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	....	....
							People's Pass. Ry. Stk. trs. cert. g. 4s.	5,698,210		1910	J. & J.	102	108
							Phila. City Passenger Ry. 1st mtg. 5s.	200,000	200,000	1917	F. & A.	104	105
							Philadelphia Trac. Co. Coll. tr. g. 4s.	1,300,000	1,018,000	1903	A. & O.	....	....
							Thirteenth & 15th St. Ry. 1st mtg. 7s.	100,000	100,000	1911	A. & O.	....	....
							Union Passenger Ry. 1st mtg. 5s.	500,000	500,000	1945	A. & O.	....	....
							Union Traction Co. Col. tr. 4s.	29,735,000	29,724,876	1905	A. & O.	....	....
							West End Passenger Ry. 1st mtg. 7s.			1906	A. & O.	115%	....
							West Phila. Pass. Ry. 1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	116%	....
							West Phila. Pass. Ry. 2d mtg. 5s.	750,000	750,000	1926	M. & N.	....	....
							†The trust certificates were issued to pay for the shares of the Electric and People's Traction Lines purchased.						
							Pittsburg, Pa.						
							Date of Quotation—June 20, 1898.						
							Birmingham, Knox & Allentown. 6s.	500,000	500,000	1931	M. & S.	....	....
							Central Traction Co. 1st mtg. 5s.	375,000	375,000	1930	J. & J.	....	....
							Citizens' Traction Co. 1st mtg. 5s.	1,250,000	1,250,000	1927	A. & J.	....	....
							*Duquesne Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	109%	110
							*Fed'l St. & Pleas. Val. Jack's Run. 5s.	50,000	50,000	1913	J. & J.	....	....
							Fed'l St. & Pleasant Valley. Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	....	....
							Millvale, Etna & Sharpsburg. 5s.	750,000	750,000	1923	M. & N.	....	....
							Pittsburg, Crafton & Mansfield. 5s.	250,000	250,000	1924	J. & J.	106%	107
							Pittsburg Traction Co. 1st mtg. 5s.	750,000	750,000	1927	A. & O.	....	....
							Pittsburg & Birmingham. 1st mtg. 5s.	1,500,000	1,500,000	1922	M. & N.	102%	....
							Pittsburg & West End. 1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
							*Pgh., Allegh. & Manch. Gen. mtg. 5s.	1,800,000	1,400,000	1930	A. & O.	111%	112%
							Second Ave. Traction Co. 5s.	2,500,000	2,000,000	1934	J. & D.	....	....
							Sub. Rapid Transit Railway Co. 6s.	500,000	500,000	1918	M. & S.	....	....
							Providence R. I.						
							Date of Quotation—June 20, 1898.						
							Newport Street Ry. Coupon 5s	50,000		1910	J. & D.	....	....
							United Trac. & Elec. Co. 1st mtg. g. 5s	9,000,000	8,247,000	1938	M. & S.	105	107
							St. Louis.						
							Date of Quotation—June 20, 1898.						
							†Baden & St. Louis RR. 1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	101
							Cass Ave. & Fair Gds. Ry. 1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
							Citizens' Railway Co. 1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
							†Comp. Hts., Un. De. & Mer. Ter. 1st 5s	1,000,000	1,000,000	1919	J. & J.	111	112
							New Haven Conn.						
							Date of Quotation—June 20, 1898.						
							New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	....
							New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
							Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	105	....
							Winchester Avenue RR. Debent. g. 5s.	100,000	94,000	1909	M. & S.	102	....
							Detroit, Mich.						
							Date of Quotation—June 20, 1898.						
							Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,885,000	1905	A. & O.	96%	99
							Fl. Wayne & Belle Isle Ry. 1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
							The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
							*\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
							New Haven Conn.						
							Date of Quotation—June 20, 1898.						
							New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	....
							New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
							Winchester Avenue RR. 1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	105	....
							Winchester Avenue RR. Debent. g. 5s.	100,000	94,000	1909	M. & S.	102	....

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—June 20, 1898						
Fourth St. & Arsenal St. Ry. 1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	97	100
Jefferson Avenue Ry. 1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co. 1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co. 1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	107
Mount City RR. Co. 1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co. 1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co. 2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co. 1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry. 1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry. Income 5s.	300,000	800,000	.....	.....	60	64
Southern Electric Ry. Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry. 1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co. 1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co. Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June, 1898.						
California St. Cable RR. 1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
Ferries & Cliff House Ry. 1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co. 1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co. 1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
Omni-Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR. 1st mtg. 6s.	350,000	350,000	1912	J. & J.	108½	.....
Park & Ocean RR. 1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry. 1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co. 1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—June 20, 1898.						
Belt Ry. Co. 1st mtg. 5s.	500,000	450,000	1920	J. & J.	45	....
Columbia Ry. 1st mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home Ry. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co. Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—June 20, 1898.						
Bridgeport Traction Co. 1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co. Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind'polln) 1st cons. m. 5s.	4,000,000	3,000,000	1933	M. & N.	79	80
Crosstown St. Ry. (Buffalo) 1st mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry. 1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	102½	108
Crosstown St. Ry. (Colu's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry. 1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'y Co. Cons. m. g. 5s.	4,000,000	922,000	1903	A. & O.	70	78
Louisville (Ky.) Ry. 1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	3,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry. Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry. 1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95½	.....
St. Paul City Ry. Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
St. Paul City Ry. Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$960,000 reserved to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—June 20, 1898						
Edison Elec. Illuminating Co., Boston....	2,026,000	.....	Quar.	156	.....	.....
General Electric Co., gold coup. deb. 5s...	10,000,000	8,750,000	1922	.....	108	.....
Pittsburg, Pa.						
Date of Quotation—June 20, 1898						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 4s.	260,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(June 20, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s...	4,312,000	4,312,000	1910	.....	110	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,116,000	1933	.....	117½	.....
Edison Elec. Ilig. Co. (Brooklyn)	2,500,000	1,500,000	1940	.....	113½	.....
Edison Electric Light (Philadelphia) ...	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 6s.	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) ...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—June 20, 1898.						
American Bell Telephone 7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—June 20, 1898						
American Electric Heating 5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 5s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. 7s.	.....	.....	1942	J. & J.	95	100
Carborundum Mfg. Co. 6s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	73,800	.....	.....	.....	.....	.....
*Unlisted						
†Reminal						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 11.80@12c. casting, 11½@11½c.

Lee, Higginson & Co., of Boston, offer the Bell Telephone 4 per cent. ten-year debentures at 102 and interest.

The Edison Electric Illuminating Company of Brooklyn has declared a quarterly dividend of 1½ per cent., payable July 15.

The American Bell Telephone Company has declared a quarterly dividend of 3 per cent. and an extra dividend of 1½ per cent., payable July 15.

The Baltimore City Passenger Railway Company has declared a semi-annual dividend of 5 per cent., payable July 1 to stock of record June 18.

The Boston Elevated Railway Company, lessee, has declared a semi-annual dividend of 4 per cent. (\$2 per share) on West End Street Railway stock, payable July 1 to stock of record June 15.

Judge Woolson, in the Federal Court at Des Moines, Ia., has approved the sale of the Ottumwa Electric Railway, Heat & Power Company's plant, which was recently sold to the bondholders' committee for \$190,000.

The engineers of the Department of Bridges, New York, have made a report to the Commissioner strongly urging a change in the electric specifications of the new Harlem River bridge at Third avenue, so as to bring them up to date.

It is officially announced that the Capital Traction Company of Washington, D. C., will on the 1st of July pay seventy-five cents on each share, which is at the rate of 3 per cent. on the par value of the stock and nearly 4 per cent. on the market value.

The Chicago City Railroad Company, according to press reports, has purchased the General Electric Railway for \$950,000, and will increase its capital stock from \$12,000,000 to \$14,000,000 in order to pay for that property and provide for improvements.

The Brooklyn Elevated Railroad ran its first passenger train across the Brooklyn Bridge on Saturday last. The regular schedule is not yet arranged. It is the intention eventually to withdraw the bridge trains and allow the elevated roads to operate the bridge railroad.

A report comes from Philadelphia that the Welsbach Light Company is to enter the electric light field and has perfected an electric incandescent burner which it is claimed is as far superior to the ordinary electric incandescent burner as the Welsbach gas burner was to the old time gas burner.

The Edison Electric Illuminating Company of New York reports for May: Gross earnings, \$246,794, an increase of \$58,004, and net \$106,789, an increase of \$24,094. From January 1 the gross earnings were \$1,326,567, an increase of \$270,661, and net \$605,772, an increase of \$97,263.

The committee on railroads of the Chicago city council has recommended for passage the ordinance granting a fifty-year franchise to the Wisconsin Inland Lakes & Chicago Railway Company, which offers as compensation for the use of certain streets in Chicago for the term of the franchise \$735,000.

At the annual meeting of the Chicago Edison Company held on the 14th inst. the old officers and the following directors were elected: Edward L. Brewster, F. S. Gorton, Samuel Insull, R. T. Lincoln, Joseph Leiter, J. J. Mitchell, Erskine M. Phelps, Byron L. Smith, A. A. Sprague, A. F. Seiberger, Lambert Tree. The number of directors was reduced from thirteen to eleven.

It is stated that the Edison Electric Illuminating Company of New York is about to send a number of engineers abroad for the purpose of reporting on the methods in use in Europe for the generation, distribution and sale of current. The commission, which leaves in a few days, is composed of J. W. Leib, Jr., general manager; J. Van Vleck, constructing engineer, and Arthur Williams, general inspector.

Adolph G. Greenberg, of New York, has allowed judgment to be taken against him for \$30,686 in favor of Austin B. Fletcher on a claim against Mr. Greenberg as indorser on eleven notes of the Atlantic Highland, Red Bank & Long Branch Electric Railroad Company, of which he was formerly president. The company went into the hands of a receiver on May 23, with liabilities reported at \$650,000 and assets at \$450,900. Mr. Greenberg has been served with the summons.

The State Board of Public Works of Ohio has adopted a resolution authorizing W. G. Wagenhals of Dayton to make a practical test of the use of electricity as a motive power for canal transportation. He is given the privilege of making a three-year test subject to the approval of the Governor. His operations are to be confined to the Miami & Erie Canal, and if he succeeds in demonstrating that he can make use of electricity to cheapen transportation as well as to accelerate it to the satisfaction of the board, he is to be given a three-year franchise over that particular canal.

The committee of preferred stockholders of the General Electric Company appointed two years ago have issued a circular to their constituents setting forth that they have been unable to procure the payment of dividends, that the assets are worth at least 72 per cent. of the par value of the common and preferred stocks, and that a proposal will be made that the par value of the common stock be reduced to \$60 a share. This proposal will be voted upon by the stockholders at an early day and proxies are solicited in favor of the proposition.

John A. Brill, on account of other business engagements, is understood to have found it impracticable to serve as a director of the General Electric Automobile Company of Philadelphia. The Philadelphia "Times" states that a gentleman connected with the company says that "the management had no other aim in bringing the stock out on the Philadelphia Stock Exchange than to divert public attention to a new industry which has before it a great future. The Hunter patents, owned by the company, are broad and comprehensive and legally unassailable. Under them it is proposed to at once engage in the manufacture of various types of electrical vehicles. The management is now chiefly concerned with the commercial development of the company, ignoring the stock market aspects of the stock."

The Boston "Advertiser" states that the trustees of the Street Railway & Illuminating Properties Company say that the reports about the street as to a coming dividend of a considerable amount in the stock are untrue. This is given as the present condition of the company: At the close of the last fiscal year the securities held by the company had a par value of \$5,157,955. Since then the outstanding preferred stock, aggregating 4,129 shares, has been retired at about \$110 and interest. The company has declared one dividend of \$3. Allowing \$135,000 for this requirement and \$454,190 for the redemption of the 4,129 shares of preferred stock, the proceeds of security sales this year have aggregated nearly \$600,000, not including the expenses of sales.

The annual meeting of the North American Company was held on the 15th inst. The annual report showed an income of \$50,102 and expenses and taxes of \$36,402, leaving a surplus of \$13,640. The company has no debts of any kind except an old open account of \$17,060. The assets of the concern on May 31 are stated as follows: Milwaukee Electric Railroad preferred, \$2,416,500; Milwaukee Electric Railroad common, \$3,078,000; Milwaukee Electric Railroad 5 per cent. bonds, \$55,000; Cincinnati Electric Light stock, \$382,700; Cincinnati Electric Light bonds, \$300,000; miscellaneous securities, \$25,009; accounts receivable, \$161,025; demand loans, \$337,543; cash, \$219,205. The company is stated to be in a position to reach out for new business that may commend itself to a conservative management.

ELECTRICITY.

Vol. XIV.

NEW YORK, JUNE 29, 1898.

No. 25.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:

UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	iv
Classified List of Advertisements,	viii
Editorial Notes,	385 386
Another Startling Invention.	
The Automobile Exposition in Paris.	
The Philadelphia Exhibition.	
Electrical Equipment of the Alabama.	
Under the Searchlight,	386
The Trans-Mississippi Exposition,	386
General Distribution from Central Stations by Direct Currents. By L. A. Ferguson,	387
A South African Industrial and Art Exhibition,	389
General Distribution from Central Stations by Alternating Currents. By Herbert A. Wagner,	389
The Distribution of Electrical Energy in Paris. By J. Laffargue,	392
On the Abuse of Power Houses. By W. H. Preece,	393
Meeting of the American Institute of Electrical Engineers,	393
Canadian Electrical Association,	393
Teaching Through the Phonograph,	393
Legal Notes,	394
Canadian Notes,	394
The News,	394
Lighting Plants—Street Railways—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Recent Company Elections,	395
Commercial Paragraphs,	395
Incorporations,	396
Electrical Patent Record,	396
Telephone and Telegraph,	396
Electrical Securities—Stocks, Bonds, Etc.,	397
Notes for Investors,	400

EDITORIAL NOTES.

Another Startling Invention.

Herr Szczepanik, who recently invented the telestroscope, or as he calls it, the Feruseher, which was described in an issue of our paper some time ago, has again startled the scientific world with another electrical invention even more important from a practical standpoint than his alleged apparatus for seeing by electricity. This new invention, which, like all of Herr Szczepanik's productions, is more or less clothed in mystery as to the exact details of operation, is a device for greatly simplifying the present method of weaving. With the looms now generally in use a design to be woven must first be resolved into very small squares. In the larger pieces of textile goods the designer is obliged to fill up thousands of such little squares before it is possible to punch the stencils plates. This operation has sometimes taken months to accomplish. By the use of a suitably ruled screen, which is nothing more nor less than a large photographic plate on which the picture which the web is to show is produced, the former tedious process is done away with. A few minutes' exposure suffices to produce on the sensitive plate or paper an image showing the points of intersection needed. The developing, it is claimed, occupies a quarter of an hour, when the design is finished. The various colors the web is to have are shown by different signs or figures which are produced by means of corresponding stops in the objective. The next process is the punching of the Jacquard stencils. Ordinarily this has to be done by a special machine, each square being cut out separately. Herr Szczepanik does away with this tedious process and by means of carbon transfers the design onto a thin sheet of metal and thus obviates the necessity of making the Jacquard stencil on silver bromide paper. The procedure is then said to be practically the same as in zinc etching; the parts of the design exposed to the light are covered with gelatine, while in the non-exposed ones the metal remains bare. In this way good and bad electrical conductors are formed, all the points on the metal plate representing holes being good conductors and offering little resistance to the passage of the current. The plate is then placed in a specially designed machine which passes it automatically under a row of contacts which are connected with electromagnets that set in motion levers which punch the plate. By means of a similar contrivance attached directly to the loom the inventor sets in motion not only the punching levers, but also the threads in the loom, thus weaving direct from the original design plate by means of electricity.

As in the case of the telestroscope, Herr Szoze-

panik, it is said, purposes to exhibit an electric loom for the first time at the Paris Exhibition, where it will weave silk handkerchiefs with the purchaser's likeness woven into them in the short space of half an hour.

If Herr Szozeapanik continues to bring out new and startling inventions at the rate he has lately, between now and the time the Paris Exposition opens there should be quite an array of wonderful exhibits by the Galician schoolmaster.

* * *

The Automobile Exposition in Paris.

Automobiles as a method of locomotion appear to be growing in popularity, especially in Paris. Although a few electrically-propelled hansoms are to be seen driving

around the streets of New York, the residents of the French metropolis have enjoyed horseless vehicles in steadily increasing numbers for a much longer time, the interest centering in this form of vehicle prompting an automobile exhibition to be held. This international automobile exhibition, inaugurated in the Tuileries Gardens on Wednesday, June 15, is probably the first of the kind ever held. The exhibits consist not only of electrically-propelled vehicles of steam and of mineral-spirit motor-driven carriages, but in a hundred and one necessary articles, such as tires, lamps, different grades of oil, tools, etc., which make up the appendages.

This Paris exhibition is attracting considerable attention and many advantages should be derived from it. It admits of a comparison being made of what has been accomplished in the automobile line during the past few years, and stimulates public interest in this line of industry. Although the exhibition is designated international, there are but few vehicles that are not of French make. The Pope Manufacturing Company of Hartford, Conn., however, has one of its Columbia two-seated motor carriages on exhibition, which from all accounts compares favorably with the other exhibits. The Compagnie Générale des Voitures de Paris shows a number of its new electric cabs, which it is said are shortly to be placed at the convenience of the public. The motors used weigh about 1,500 pounds, and by a novel arrangement, coupé, victoria or small landau bodies are interchangeable, and either of these may be placed over the motor and attached. The advantages claimed for the electric carriage is that it is extremely simple in construction, there being little or nothing to get out of order, is under perfect control in crowded streets, and the small amount of current required to keep an electric carriage running makes it inexpensive as compared with the cost of hay and grain, stabling, harness, etc., required for horses. On the other hand, care has to be exercised to prevent the battery from

becoming discharged at a distance from a station. A point well worth noticing with reference to the Paris exhibition is apparently the small amount of attention given by the French manufacturers to the utilization of the automobile for delivery wagon purposes.

Judging from the present state of the automobile industry in this country, it should not be long before many of our large stores adopt this method of delivering parcels, as already one or more houses have placed orders for a number of such vehicles. As we stated in an editorial some months ago, a wide field would seem to be open to the automobiles in this line, as the conditions are favorable to their use in work of this character. Storage batteries can be procured of moderate weight capable of propelling a vehicle of this nature twenty-five miles, and moreover, in a city an automobile delivery wagon would not be apt to get at any great distance from a point where a set of charged batteries could be procured.

* * *

The Philadelphia Exhibition.

This unquestionably is an era of exhibitions. The Philadelphia Electrical Show, following that held in this city, is now in full swing and attracts nightly a large number of visitors. There would appear to be nothing strikingly new in the Quaker City Exhibition, or that was not to be seen in Madison Square Garden during the month of May. Moore's vacuum tubes, which illuminated so perfectly the Chapel in the Garden, are to be found in Philadelphia illuminating the hangings of an Oriental smoking-room, and have so far proven one of the principal features of attraction.

In front of the building there are a large number of arc lamps, aggregating, so it is claimed, 120,000 candle power. On the first floor there is a rotunda in which is situated an electric fountain around which, in a gallery, a band plays. There are many attractive company exhibits tastefully arranged and brilliantly illuminated. Lectures on electrical topics of interest are frequently given which are both entertaining and instructive. As this is the first Exhibition of the kind that has been held in Philadelphia since that given under the auspices of the Franklin Institute in 1884, it is naturally receiving considerable attention. It seems unfortunate however that the Philadelphia show follows so closely on the heels of that given in Madison Square Garden, as many persons who would have attended it had already witnessed in New York the exhibits that lend it its chief attractions.

* * *

Electrical Equipment of the Alabama.

Unquestionably the American Navy is electrically the best equipped in the world, and every new man-of-war completed marks an advance in naval electrical installation. Not only will more powerful electrical appliances be used on the United States ships recently launched than on those now in commission, but the electric current will be put to new uses.

The battle-ship Alabama, recently launched at the Cramps' shipyard, Philadelphia, will when completed probably be the best electrically equipped man-of-war afloat, if we except the Illinois and Wisconsin which will have identically the same equipment.

How well the Alabama will be provided for so far as electrical apparatus is concerned will be gathered from the fact that there will be eight generating sets, or four times as many as the unfortunate Maine was provided with. There will also be a total of 770 incandescent lamps, or 372 more than were thought necessary for lighting the Maine. Four searchlights will be provided as a protection against torpedo boats, with either parabolic or Mangin mirrors. Provision is also made for two sets of electrical night-signaling apparatus, with spare lanterns such as are

now generally in use on the vessels of our Navy, two diving lamps, four portable electric ventilating sets, and twelve one-twelfth horse-power electric desk or ceiling fans. The Alabama as well as the other two vessels will be supplied with but one main switch-board, from which twenty-five battle circuits and seven lighting circuits will lead. There will be 772 outlets, and a total of 789 lamps with a capacity of about 623 amperes. The thirty-two circuits require twenty feeders, which will be divided up into sections. The fixtures for the incandescent lamps will include sixty-five battle lanterns, over 130 bulkhead and forty-nine bunker lamps, four cargo reflectors, thirty-five magazine lanterns, the necessary running lights, and lights for the engine room telegraphs, helm telegraphs and indicators, and for the binnacles. In short it may safely be said that the electrical equipment of the Alabama will be in all things up to date.

After the experience gained by the United States fleet at the Philippines it would certainly seem advisable to add to the very thorough electrical equipment of the Alabama suitable submarine telegraphing instruments such as a mirror galvanometer and Morse apparatus. Were a suitable outfit of this nature provided, with a competent person to handle it, the electrical equipment of our new battle ships would be everything that could be desired.

Under the Searchlight.

Notes and Comments on Various Topics.

A CONUNDRUM and its answer attributed to a prominent participant in the recent N. E. L. A. Convention seem to have met with general approbation as conveying a recognized truth with axiomatic directness. The conundrum was, "When is an electrician not an electrician?" the answer being, "Nineteen times out of twenty." What this suggests is some term that can be properly applied to the nineteen who are misplaced. Who will provide a suitable name for these neophytes in the profession?

* * *

THE New York Sun says: "Some modern inventions are a boon to humanity and others are not. The phonographic clock which has just been launched upon the market in Germany belongs to the latter category. One must admit the alarm clock in the theory of modern life, but a phonographic alarm clock adds insult to injury. If one must be awakened, one must; but how can one turn over and take the final luxurious forty winks when the depressing programme of a busy day has been shouted into one's ears? Things that seemed natural and practicable the night before present an appalling front in the early morning; and the breakfast hour, announced in strident tones, is much more insistent than when suggested by an impersonal metallic clang. Some valuable possibilities the new invention does possess. The housewife needn't laboriously explain breakfast details to the servant at night, and find the next morning that all important points have been conscientiously forgotten. She sets the phonographic alarm for an early hour, talks directions into it, and the next morning the cook is awakened by a stern voice telling her exactly what is expected of her in regard to breakfast preparation. Paterfamilias, too, can work the combination. No more will he sit up until his pretty daughter's caller goes home and resort to time-honored hints to hasten the departure. He will not slam shutters and noisily lock doors and bid the other members of the family good night at the top of his voice and drop his shoes on the bedroom floor with a force that shakes the parlor chandeliers, and call down to the daughter that she must be careful about turning off the gas and locking the door. He will never be goaded by a sense of parental duty into walking into the parlor and making a scene and reducing the daughter to a point of tears. Oh, no; he will simply set

the phonographic alarm for the hour when he thinks young men should end their calls. Then he will go serenely to bed; and when the fatal hour strikes a specimen of the old gentleman's finest irony will be hurled at the offending guest. Exit young man. The maiden wrathfully weeps alone."

* * *

A BARE iron wire and an insulated copper wire wound helically on an iron core with water as the electrolyte constitute a novel primary battery of a Kentucky inventor from which great things are expected. It is claimed the form increases the output of current while yielding inductive effect that may be utilized in a secondary coil. The cell may serve as a self generating electromagnet, and is said to be adapted for telephone, telegraph and electric bell purposes and is especially valuable in electro-therapeutics.

* * *

IN Massachusetts legal sanction is given to the distinction making a street car line a "railway" while a steam line is a "railroad." General adoption of this rule is advisable.

The Trans-Mississippi Exposition.

A writer in *Bradstreet's* gives a description of the Exposition now in progress at Omaha, Neb., from which we extract the following:

"Visitors to the Exposition have been surprised at the magnitude and beauty of the grounds and buildings, and all agree that the Columbian Exposition at Chicago excelled it only in size and not in beauty. In round figures the Trans-Mississippi Exposition represents an expenditure of about \$1,200,000. The grounds cover two hundred acres, located within fifteen minutes' ride by electric cars from the heart of the city. The central feature of the Exposition is a large lagoon of artificial construction, several hundred feet wide and about one-half mile in length. Around this lagoon, at a distance of a hundred feet or more, are located most of the main buildings, all of classical design and harmonious as a whole. They are constructed of staff, as the buildings were at the Chicago Exposition, but unlike any other Exposition these buildings are connected by artistic colonnades, which afford shaded and sheltered walks by which visitors can pass from one building to the other. This feature of the Exposition alone distinguishes it from any other recently held, and gives to the grand court, in which the lagoon is located, a unique appearance.

"At night this grand court is illuminated by some fourteen thousand electric lights, a larger number than ever before installed for the illumination of any place. Those who have seen the grand court thus illuminated at night declare that it is a veritable fairy land, rivaling in beauty any scene in the world. At the end of the grand court, where stands the great building constructed by the United States, the lagoon broadens into a harbor, whose central feature is a beautiful electric fountain, and this harbor is outlined by colonnades, which extend in a circle from the Government Building on either side of the lagoon, one to the Agriculture Building and the other to the Fine Arts Building, suggesting very much the approach of St. Peter's in Rome, which effect is heightened by the Government Building, which carries out the idea by its style of architecture.

"Connected with the Exposition there has naturally developed during the year a plan to attract national conventions to Omaha, and the result is that during the Exposition some fifty or sixty conventions will be held in Omaha, and delegates from all parts of the United States will be entertained."

The General Electric Company will owe on July 1, 1898, \$1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.*

BY LOUIS A. FERGUSON,
Chicago.

Mr. President and Gentlemen of the National Electric Light Association: The subject of central station distribution by direct currents is one which is so familiar to many of you that I hesitated when asked to write this paper, feeling that it would be difficult to present to you any new thoughts or experiences, so I trust you will pardon me if in the attempt to precipitate discussion and bring to the attention of the meeting the ideas and experiences of others, which is after all the object of my paper, I may trespass upon ground previously explored.

Nor do I wish to be construed as advocating blindly the general use of direct currents under all conditions for both transmission and distribution of electricity for lighting and power purposes in cities and towns, for records will, I think, clearly show that the writer was the first of the so called Edison central station men (who have represented the direct current idea in central station lighting) to advocate the introduction of the alternating current as a means of effecting important economies in the operating of the direct-current distribution systems, and also vastly extending their field of operation, which without the combination of alternating currents might have remained, despite their distinct advantages, unfortunately limited to a comparatively small and closely populated area.

The general design of the modern direct-current central station and its equipment has been fairly well established within the past five years, and while it was originally the custom to erect the generating stations as nearly as possible in the electrical center of the city or town, it is now generally conceded that direct current may be more economically distributed from a condensing station, situated even a mile distant from the electrical center, than from a non-condensing station located at the electrical center of the city, and it has been further demonstrated that the former practice of building many central generating stations in various centers of distribution in cities is to be supplanted by the use of one or two large condensing stations generating direct current for distribution throughout the business district if the station be within one mile of the electrical center of the district, and alternating current for transmission to sub-stations located at the electrical centers of districts more remote from the main generating station. In some cities water for condensing purposes may not be easily obtainable within a distance of one mile, and the location is then merely a question of total cost of land, building and transmission lines to the various distributing stations, proper consideration being given of course to the limitations of line voltage and insulation.

In order to show the workings of the first mentioned type of modern direct-current central station systems, I will explain in a general way the method of distribution employed in the system of the Chicago Edison Company, which I think fairly represents the latest development in direct-current distribution, and leave the explanations of the methods of direct-current distribution in other cities to the representatives of the companies operating them.

The system of distribution is a solid network of underground conductors on the three-wire system, extending from North avenue to 39th street, a distance of six miles north and south, and from Lake Michigan to Blue Island avenue, a distance of one and one-half miles east and west. The entire network is continuous from end to end, and is supplied at present from four central stations, all connected in parallel through the network and each feeding into it. The two large stations located at Harrison

street and Washington street on the Chicago River, and known as Stations No. 1 and No. 5 respectively, are condensing plants, while the stations on the north side and south side, located at North Clark and Oak streets and Wabash avenue and 27th street, known as Stations No. 4 and No. 2 respectively, are non-condensing.

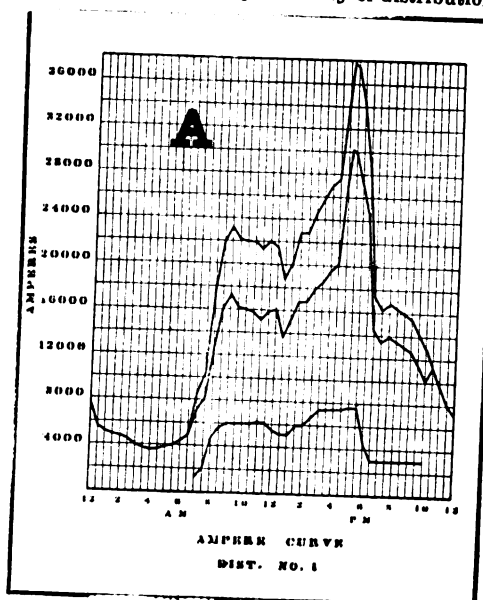
The total current furnished to the network at the time of maximum load of the system in the winter of 1897 was 50,730 amperes, and is divided as follows:

Station No.	Amperes.	Per cent of total.
Station No. 1.....	35,000	70.2
Station No. 5.....	7,600	15.0
Station No. 2.....	3,400	6.7
Station No. 4.....	4,180	8.1
	50,730	100.00

The total low tension direct current kilowatt hours output for the stations for the fiscal year of 1897 was 15,255,466, divided as follows:

Station No.	Low tension Kilowatt hours.	Per cent. of total.	Maximum station voltage.	Yearly average station voltage.
Station No. 1.....	11,835,618	77.3	149.	126.2
Station No. 5.....	2,814,473	18.5	142.5	129.6
Station No. 2.....	808,158	5.3	135.0	119.0
Station No. 4.....	797,217	5.2	123.5	120.1
	15,255,466	100.0		

The pressure at the feeder ends throughout the system is maintained at 115 volts on each side of the three-wire system. Although the maximum station pressure is 149 volts, the average pressure of all stations for the year is 126.2 volts, giving an average loss of pressure of 11.2 volts or 8.8 per cent., which means an average yearly efficiency of distribution of



91.2 per cent. from the station switchboard to the customer's meter.

The center of distribution in the business district of the city is at Adams street, between Clark and LaSalle streets. Station No. 1, which, as has been shown, furnishes 74.3 per cent. of the total low tension output, is located on the Chicago River at Harrison street, 3,340 feet distant from the center of distribution at Adams street. Station No. 5, which furnishes 15 per cent. of the total low tension output, is located on the Chicago River at Washington street, and is 4,500 feet from Station No. 1 and 3,000 feet from the Adams street sub-station.

These two stations furnish all the low tension output for the district bounded by the river on the north, Harmon court (approximately) on the south, Lake Michigan on the east and the river on the west. They also furnish all the energy for the entire low tension system of the city during the hours from midnight until dusk the following afternoon, and a portion of the output of Districts No. 2 and No. 4 from dusk until midnight daily, and ultimately they will furnish all of the output of the territories mentioned and all of the energy required for alternating transmission lines into the outlying districts of the city and its suburbs.

The load curves "A," here shown, indicate the

amperes furnished in District No. 1 by Stations No. 1 and No. 5, the small lower curve representing that delivered by Station No. 5, and the lower large curve showing that delivered by Station No. 1, and the upper curve representing the total amperes delivered to District No. 1.

The distribution of current from these two stations to the underground network is as follows:

From Station No. 1 to the Adams street sub-station is laid an immense trunk line known as the Adams street trunk line, having a total cross-sectional area of 68,000,000 circular mils, 28,500,000 circular mils being ordinarily connected on the positive and negative sides and 9,000,000 circular mils in the neutral. The length of this trunk line is 3,840 feet, and is made up of fifteen special Edison tubes, each 3,000,000 circular mils area, laid directly in the ground, and fourteen 1,500,000 circular mils stranded rubber insulated, lead-covered and juted cables drawn into cement-lined iron ducts. The trunk line on leaving Station No. 1 goes down a shaft 60 feet, thence through a brick tunnel built especially for it in the river bed to the east side, where it rises again in another shaft 60 feet into the tunnel house, where a small switchboard is located. The portion of the trunk line in the shafts and tunnel, which is 430 feet in length, is made up entirely of cables; of these forty-five are 1,000,000 circular mils Siemens jute insulated and fourteen are 1,500,000 circular mils General Electric rubber insulated, leaded, asphalted and iron-armored submarine cables, each supported on iron racks. Where the cables hang vertically in the shaft, the cable is supported by the iron-armored sheathing clasped between iron plates on a heavy cast iron ring. The copper conductors thus hang in a sort of basket, the strain being distributed throughout the length of the cable. At the tunnel house the forty-five Siemens 1,000,000 circular mils cables connect with fifteen 3,000,000 circular mils single pole Edison feeder tubes, and, together with the fourteen 1,500,000 circular mils cables, are mounted on racks in a large subway, into which the duct line enters about 200 feet east of the tunnel house. At intervals of about 500 feet manholes are built in the Edison tube portion as well as in the conduit portion of the trunk line, thus affording a quick means of locating low insulation points as they develop. Each of the tubes and cables is provided with an amperemeter at Station No. 1, and with switches at both ends so that they may be completely disconnected from the system in case of trouble. Two of the 3,000,000 circular mils tubes are provided with throwover switches and arranged so that they may be quickly connected either to the positive or neutral or negative or neutral at will. All of the cables are provided with throwover switches at both ends, so that they may be operated either as positive or negative at will, thus providing for any possible contingency that may arise. At the Adams street sub-station the trunk line feeds into the main bus-bar in the distribution room, and from the switchboard forty-two feeders radiate to various points in the business district, ranging in size from 250,000 circular mils to 1,000,000 circular mils, and in length from 290 feet to 2,831 feet, the average size being 485,000 circular mils, and the average length of feeder 1,373 feet.

The maximum current in amperes carried over the trunk line and distributed from the Adams street sub-station last December was 34,400 amperes, the maximum loss of pressure on the trunk line being 12.4 per cent., and to the customer's meter 22.8 per cent., the distance to farthest feeder end being 6,171 feet. In addition to the current furnished to the trunk line, Station No. 1 also delivers from its main bus-bar current to the two 1,000,000 circular mils feeders which feed into two points in the southern portion of the business district. One of these feeders terminating at Washington avenue and Harrison street is 3,800 feet in length and carries with maxi-

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

sum station pressure 780 amperes on each side, the other terminating at Eldredge Court and State street is 4,800 feet in length and carries with maximum station pressure 620 amperes on each side. The supplying of District No. 1 by Station No. 5 is done in much the same manner as that just described by the two feeders from Station No. 1 into the southern portion of the district. From Station No. 5 eight feeders, varying in size from 400,000 circular mils to 1,000,000 circular mils, and in length from 2,175 feet to 4,445 feet, terminating at different points in the northern section of District No. 1, deliver a total of 7,600 amperes at maximum station pressure of 140 volts, the amount of current furnished during the run being only enough to maintain standard steam pressure at the feeder ends, the curve of station voltage following very closely that of Station No. 1.

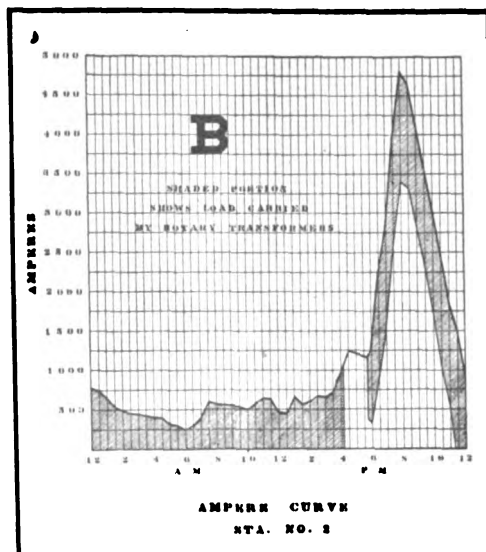
Station No. 2, which is now really a rotary transformer sub-station, is 17,500 feet from Station No. 1, and 14,300 feet from Adams street sub-station. The load diagram "B" shows the amperes delivered to District No. 2, the cross-hatched portion representing the current furnished through the rotary transformers and the unshaded portion representing the current furnished by the dynamos in Station No. 2, the dynamos and rotary transformers operating in parallel on the three-wire system. The upper curve shows the total amperes delivered to District No. 2.

Station No. 4, which now operates only from dusk till midnight, and will later become a sub-station, is 11,500 feet from Station No. 1, 9,000 feet from Station No. 5, and 8,000 feet from Adams street sub-station. The load diagram "C" shows the amperes delivered to District No. 4. The portion of the curve from midnight until 3:30 P. M. on the winter day and until 6:30 P. M. on the summer day is furnished from District No. 1 through the interconnected underground network, the District No. 4 being during these hours merely an extension of District No. 1 and having no distinct supply delivered through its own switchboard. From dusk till midnight the generating plant in Station No. 4 is operated, and the current is delivered as shown by the next to the highest curve on the diagram, the low curve marked No. 5 representing the amperes furnished by Station No. 5 to District No. 4 over a direct-current tie line between the switchboards of the two stations. The tie line is made up from one feeder running out of Station No. 5, originally feeding into District No. 1 and now connecting by means of river cables with a feeder out of Station No. 4, which formerly fed into the district at a southern point. This tie line is also used on dark days to keep up the pressure in District No. 4 by connecting onto the main bus in Station No. 5 and allowing it to take a small current and deliver it to Station No. 4 switchboard, thus relieving the network between Districts No. 1 and No. 4 of some of the work. Between the hours of midnight and 8 o'clock in the morning there is only one low tension direct-current generating station operating (Station No. 1), supplying direct-current to District No. 1, and through the network to District No. 4.

District No. 2 is supplied from Station No. 1 by means of a converse rotary transformer connected to the 250 volts direct-current bus-bars, converting to three phase alternating current at about 160 volts. By means of step-up transformers this is raised to 4,500 volts, and at this pressure the energy is transmitted by three-phase underground transmission line to Station No. 2, where it is reduced by step-down transformers to about 80 volts and converted by means of rotary current transformers to direct current at about 115 volts.

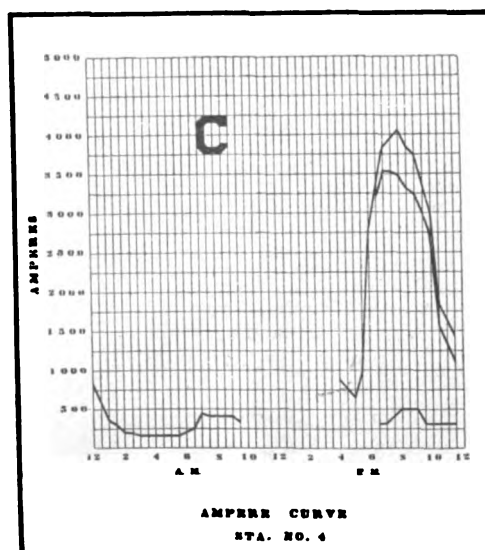
For the permanent conversion of Station No. 2 into a sub-station a pair of special 200 kilowatt generators are being installed, directly coupled to the existing 600 HP. triple expansion engines in Station No. 1. Each generator is provided with a commu-

tator and a set of three collector rings, and is designed to deliver from the same armature direct currents and three phase alternating currents, the direct current sides of each pair of machines being connected in series to form a three wire unit, and the alternating current sides, after passing through transformers stepping up to 4,500 volts, being connected in multiple. The alternating current from these machines will be taken to supply the transmission line to Station No. 2, and the balance of the capacity of the machines will be delivered directly into the main direct current bus-bar of Station No. 1, thus keeping the unit operating at full load and



maximum efficiency during its run. The peak of the load in District No. 2 arrives later than the peak of District No. 1, so that the same investment in steam and electrical machinery may be employed to take care of a portion of the peak in both districts, these special generators constituting a reserve or surplus for the direct current equipment of Station No. 1.

Lest I might wander from the subject of the paper, I shall not now dwell further upon the question of transmission of energy by alternating currents, although it plays an exceedingly important part in the



distribution of electricity by the Chicago Edison Company.

Uniformity of pressure throughout an incandescent electric lighting system is absolutely essential to commercial success. To accomplish this different methods have been proposed at different times. It often happens that the original plan of distribution, laid out by the constructing engineer, does not meet the requirements, after several years' growth of the business, for in all cities lighting business may localize at certain special points, and so demand a remodelling of the existing system of conductors, or require some means of correcting for the inequalities

of pressure that are due to the unevenly distributed load.

In the Edison systems built prior to 1890 it was customary to introduce in series with each feeder a resistance box with capacity to carry the entire current of the feeder and of resistance much greater than that of the feeder itself. The resistance box is commonly known as a feeder equalizer. From the end of each feeder where it connected with the mains a set of pressure wires was run back to the station and there connected to pressure indicators. The method of regulating was to designate the feeder supplying the most important district in the system the standard feeder, and to keep its pressure constant, say 110 volts. Each pressure indicator of the other feeders was differentially wound, so as to receive the pressure of the standard feeder as well as the pressure of its own feeder. When there was any difference of pressure between the standard feeder and a given feeder, the latter's indicator needle would deflect to one side or the other according as the pressure on that feeder was higher or lower than the standard, and if the equal of the standard, the indicating needle would stand in the center. If, then, any indicator showed that its feeder was low in pressure, some resistance would be cut out of its feeder equalizer, and the resistance diminishing, the volts loss on the feeder would then become less, and thus the feeder could be brought to the same pressure as the standard. If the pressure of the feeder were high, the operation would be the reverse.

With this method of regulation, the entire output of the station must be at such pressure at the station switchboard as will permit the delivery of the correct pressure at the end of that feeder, the product of whose load and resistance is greatest in the system. There are some large stations in America operating to-day on this plan of regulation, notwithstanding that it is an expensive and troublesome one. Another method of regulating, which may be employed where the load is fairly well distributed, is by cutting out the feeders which are high and forcing the current to travel through the remaining feeders and the mains, thus increasing the fall of pressure to the end of the feeders which were formerly high.

The only economical and safe way to regulate in a city where the distances are not abnormally great, and where the load is fairly well distributed, is to so design the conducting system that it will be self-regulating, that is, so that it will require no change of the resistance of feeders or anything of the kind.

A good conducting system should have an ample number of feeders reasonably close together, and the connecting mains should be of generous cross sectional area.

A valuable adjunct to a station, where there are one or two straggling feeders of great length so located that they cannot be interconnected with the general system so that they may be benefited by such connection, is what is known among the Edison companies as the "booster." The "booster" is a direct-current dynamo wound for a large current and low voltage, and is used for raising the pressure of the station and of the feeders which are ordinarily low. The "booster" dynamo should be series wound and so designed that its voltage will be proportional to the current passing through it, the speed remaining constant. It is connected in series with the feeder whose pressure is to be raised, and is belted to or directly connected with a motor which drives it at the speed for which it is designed. Its action is as follows: The current passing out on the feeder also passes through the field and armature of the "booster" dynamo, and an electromotive force is thus added to that already existing on the feeder due to the dynamos of the general system. As the load on the feeder increases, the electromotive force of the "booster" dynamo increases proportionately, and adds to that of the feeder, thus overcoming the loss of pressure due to the increased cur-

rent in the feeder, which enables the feeder to deliver the proper pressure at its mains. The "booster" may also be employed to raise the pressure of a number of feeders which are connected to an auxiliary bus bar. In this case, the "booster" would be connected between the main bus and the auxiliary bus, and would carry all the current of the auxiliary bus, raising the pressure of it as its load increases, and decreasing as the load decreases, as described in the case of the single feeder.

In some central stations two or more potentials or pressures are used, certain dynamos working on a bus bar at one pressure and the other dynamos working on another bus bar at different pressures.

This method is only economical when the dynamos can be worked very near the maximum load, which is not often the case. In some cities the dynamos in central stations or machinery or storage batteries in sub-stations feed into one general system at different points, each station or sub-station operating at such pressure as will deliver the same voltage at the feeder end of the mains. This is, without doubt, the method to be recommended as giving the best efficiency and assuring reliability of service throughout the system.

With the method proposed in case of accident to any one station, either by fire or lack of water supply, the whole system will not be shut down, but each station will take its share of load which comes from the shutting down of the disabled station.

(To be continued.)

A South African Industrial and Art Exposition.

United States Consul-General Stowe writes the State Department from Cape Town, South Africa, that an invitation has been extended to American manufacturers and producers to exhibit productions at the Exhibition which is to be held at Grahamstown in Cape Colony, opening December 15, 1898, and closing January 21, 1899. This Exhibition will be the second of its kind held in South Africa. It is to be an industrial and art exhibition, and great care is being exercised in the endeavor to make it a success in every way. The promoters are all men of acknowledged standing in the community, several of them having been connected with the first South African Republic, Orange Free State and Natal, and the high commissioners of Rhodesia and Basutoland. Over £100,000 have been subscribed, and exhibits from all parts of the world have been asked. There are five classifications of exhibits, viz.: (a) Raw materials; (b) manufactures; (c) mining and machinery; (d) natural history and science; (e) arts.

This Exposition will be called the South African Industrial and Art Exhibition. Grahamstown is in the southeastern part of the colony.

Consul Stowe says that the Exhibition will be of incalculable benefit to manufacturers of agricultural implements and vehicles, electrical apparatus, machinery of all kinds, cottons, woollens, etc.

American goods are becoming widely and favorably known in the South African country, and this opportunity of still further popularizing them should not be neglected by American manufacturers.

Electric Lighting in Berlin and Paris.

The *Bulletin des Usines Electriques*, in an article discussing the question of extending the time of the concession for lighting Paris, gives a few interesting details about electric lighting in Berlin, to the effect that there are some 300,000 incandescent lamps of 16 CP. installed, besides several thousand arc lamps. The length of mains is about 186 miles, and the power developed is about 28,000 HP. There are some 1,600 motors taking 6,450 HP. The price for lighting is 15 cents per kilowatt-hour, that for power is 4 cents. Paris will require about 25,000 HP. for about 418,000 lamps of 10 candles and 7,448 arc lamps, with about 240 miles of mains. There will be 513 motors, requiring 1,940 HP., and the cost will be about 23 cents per kilowatt-hour.

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY ALTERNATING CURRENTS.*

BY HERBERT A. WAGNER,
St. Louis.

Ever since the installation of the first few pioneer alternating-current central stations, just ten years ago, we have heard it predicted with persistent reiteration that for the distribution of current for lighting from central stations direct current was a thing of the past, and that in a few years the alternating-current transformer system would hold the field without a competitor.

To many, this prediction may seem to have been fulfilled, considering the enormous number of alternating-current plants, compared with direct-current, that have been installed, and the remarkable impetus given to electrical industries by the development of alternating currents.

The great success achieved in the transmission of power by polyphase alternating currents in the last three years has but strengthened this general belief, and left fewer champions to adhere to the direct-current cause.

These great achievements, I say, have led the enthusiast to think all progress confined to alternating systems of distribution. Deeper investigation, however, shows that while in point of number the alternating-current stations, reaching into the thousands, completely overshadow those of direct-current, there are few really large stations, outside of water-power plants, that are to-day employing alternating currents for distribution, and that while enormous investments have been made in direct-current stations in our larger cities, comparatively small amounts have been invested in alternating-current work.

The alternating system was heralded as providing a means of distribution with a great reduction in first cost of plant, and for years the development of the system has been made with this the principal end in view. On the other hand, direct-current distribution in the form of the Edison three-wire system has been steadily and intelligently developed to the highest standard of economy of operation, simplicity and permanence. In the same city, alternating-current stations have not, as a rule, been successful in competition with three-wire stations; their service has not been as good, and their profits have been smaller.

I may startle many by stating frankly the discouraging fact, which has been barely whispered at times, that, judged by the standards of the magnificent Edison properties in many of our larger cities, few alternating-current central stations in the United States have been a success. Do not imagine that this damaging admission, however, is an indication of any loss of faith on the part of one who has been identified with alternating-current work since its debut, as it were. Far from it. The fault lies, not with the alternating current itself, but with its application. Its few apparently inherent deficiencies, such as the difficulties of operating motors and arc lamps, have been shown to have been only awaiting discovery and development, and were at our disposal almost as soon as these important divisions of central-station service were operated with success from the Edison three-wire system. These can, therefore, hardly be held responsible for the difference in the commercial results obtained with the two systems.

As I have said, the ends in view in the development of the two systems have been radically different. The one was to produce a given amount of light for the minimum of investment; the other was to provide a permanent investment that would render the maximum of profit. These standpoints in general mark the difference between the manufac-

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

turer and the user, and we find these two systems developed in this way—one almost entirely by the manufacturer, and the other by the combined efforts of the various users. The results are the natural effects of progression along these lines.

Few opportunities have we had of comparing the two systems from the same standpoint and under like conditions. The purpose of this paper is to show the alternating current applied from the same standpoint, compelled to fulfill the same conditions; and then to compare the results with the best produced with direct current.

To better contrast the different methods of distribution, we will review briefly those in general use before describing the most recent developments.

The early alternating-current stations were installed on the principle that the drop in lines with distribution at 1,000 volts was so small that it was practically negligible. Two wires were accordingly run out from the station, passing along those streets where light was to be furnished, and lights were connected *ad libitum* at any desired points between the station and the farthest end, without reference to such trifling considerations as difference in potential. Distribution was attempted in this way for years, and in many places is still in operation. Lines are even being constructed to-day without any notion of a system of feeders and mains, although an almost perfect system for the maintenance of uniform pressure was in operation in many Edison stations before the first alternating station was in existence. Fortunately for the operators of such models of simplicity, the current delivered has usually been so small in quantity that with the proverbial No. 6 wire, which seemed to possess virtues not affected by distances, the difference of pressure between neighboring customers rarely exceeded 10 per cent.

A few more enlightened experts—plants were always installed by experts in the early days—eventually conceived the novel idea that if the drop, a little of which they had discovered by that time, could be confined to a greater extent to those portions of the lines where there were no lights, some might be spared from the lighting districts. A few feeder lines were therefore stuck in here and there to boost up the pressure where it was lowest.

The regulation was all effected by means of the dynamo field rheostat, and the pressure indicated by a voltmeter on the secondary of a transformer whose primary was connected to the bus bars on the switchboard. A few lamps were also often operated by the same transformer to light the switchboard or other parts of the station. The station attendant was, of course, in absolute ignorance of the pressure at any point on the lines where lamps were used. The pressure was therefore usually run high enough to be on the safe side. The attendant was sometimes instructed to let his voltmeter needle follow gently the manoeuvres of his ammeter, as there was thought to be a more or less intimate connection between volts and amperes and the volts ought not to be allowed to get too far behind.

If any one ever breathed a suggestion of pressure wires, it was probably his last breath. At any rate, he was never heard of again. What! pressure wires with alternating current? Preposterous idea. Alternating and progression were considered almost synonymous terms. Antiquated ideas must be abandoned.

This faintly-whispered need might, however, be heard again, so, to meet the emergency, a compensating voltmeter was produced that could be adjusted for any drop in the lines. It was ingeniously arranged so that a small series transformer in the main line would send currents opposing those operating the voltmeter, thereby making the needle or index drop back approximately proportionately to the current in the line. This device was a great help, and caused the drop in lines to jump into prominence at once. It would be quite perfect if the drop in alter-

nating-current lines were proportional to the current, but it is not. The power factor of ordinary alternating-current systems is usually quite low at light loads, and except with very small wire, an ampere may therefore produce much more drop proportionately at light load than at heavy load.

One alternating-current station of which I have intimate knowledge has used pressure wires in connection with each feeder for years. There may be a few others, but they are rare exceptions even to-day.

The usual system of distribution provides a separate transformer for each customer. In many cases this implies the use of a very small transformer. It is impossible to make the efficiency of small transformers high. As each customer may at times use all of his lamps, he must have full transformer capacity for such an emergency. The ordinary ratio between maximum station loads and the number of lamps connected is in most cases under 50 per cent. where meters are employed. The transformers then being of a total capacity equal to the number of lamps connected average at best only 50 per cent. of their rated capacity at the maximum station load. In most stations the average load generated is much less than 25 per cent. of the maximum load, and therefore, with twice the transformer capacity of that represented by maximum station load, the average transformer load would not exceed 10 per cent. of the transformer capacity, all the year round.

The efficiency of the average modern transformer of usual size at 10 per cent. of its rated load is not over 65 per cent., and the average of transformers at present in use not more than 50 per cent. It is perfectly safe to say that there is not an alternating-current station to-day using individual transformers for each or neighboring customers that can show an average efficiency of distribution of over 60 per cent., and few that can show over 50 per cent.

In Europe, it is, to some extent, the practice to use transformer sub-stations with low-potential distribution from these points. Transformers are out in and out at these sub-stations by attendants according to the demand for current. It is doubtful if, after paying interest on the investment in property and housing for these transformer stations, together with the investment in instruments and switches required, and the attendants' wages, there is very much saving effected. Had we nothing better to turn to than these systems, the cost of distribution from large stations would be extreme compared with the direct-current, Edison three-wire system, and competition with the latter could not be a success.

Another very important consideration is the economy or efficiency of lamps used. To employ successfully the highest-economy lamps made, a very uniform pressure must be maintained. With the usual alternating-current system, and with an equally good disposition of feeders and mains, the variations of pressure will exceed those in a direct-current system by nearly 3 per cent., on account of the transformer drop, and to secure even this limit of variation, pressure wires must be used with each feeder.

It is not surprising to find, therefore, that almost all alternating-current stations are using lamps requiring 20 per cent. more current than those used by direct-current stations.

I cannot refrain from remarking here that to operate any station, alternating or direct current, without pressure wires, is to be worse than penny-wise and pound-foolish. In any alternating-current station employing overhead wires, the saving in lamp renewals would equal the cost of pressure wires in little over a month's time. I might also add that the total loss of lamps is not the most serious result of variations in pressure. Such variations cause a rapid decline in candle power, and low candle power means dissatisfaction of customers and the increased use of gas.

Now let us leave for the time the alternating-current station and its usual system of distribution,

and adjourn to a modern Edison station, to see if there can really be anything learned from so antiquated a source. On entering, we see at first large direct-connected generators running in multiple. We have also seen those in a few alternating-current stations, and perhaps of larger size. We next see a very compact and convenient switchboard. Neither is that altogether new. But let us ask to see the system of distribution; for that is what we most want to look into.

On the plans of this system of distribution a remarkable network of feeders and mains is laid before us, most carefully calculated for the maintenance of uniform pressure. Means for regulating more or less independently the pressure on each feeder are provided. From numerous points in the system, corresponding to the feeder terminals, pressure wires are brought to the station, and indicators show the pressure at all these points. Numerous devices and appliances are shown us which must have been the result of years of experience in the development of distribution methods. We look with admiration, and ask why, with this apparently far more perfect system in existence, have we been working so long to try to perfect a new system that cannot to-day, we are informed, produce such results. Why, indeed!

But let us look a little further. What are those massive beams? They do not seem to support anything. "Those are not beams. They are copper wires to carry the current out," we are told. "Wires? Why, they weigh tons!" "So they do, but they are necessary with this system." A very serious drawback, it would seem. Another question troubles us. Why do you occupy ground in a part of the city where property must be very valuable? Why do you not go off to one side where land is cheap? "Oh, we are forced to be near our center of business. If we were twice as far away we should have to use four times the amount of copper in those bars." This, indeed, seems a very great defect. But are there no other defects in your system? In answer, we are told that there are no others that are considered serious.

If this necessity for using such an enormous amount of copper is the weak point of a beautifully developed system, why do we not endeavor to overcome that particular point and adopt the rest, instead of starting out anew and alone to develop another system from beginning to end? This is the question that should have been considered years ago. Why did we not start where others left off, engraft our alternating current and draw energy and strength from the old roots, instead of trying to grow from the seed to find ourselves running to limbs and branches with very little trunk to speak of. We have tried to overreach our older brother, and now lack his sturdiness and stability.

It is not too late, however, to begin afresh. We are satisfied that at the present time the Edison three-wire system of distribution is the most efficient in use and the most nearly perfect in details. We know that the usual system employed with alternating current is not efficient, and does not admit of as close regulation, but it is vastly cheaper to install.

Comparing the cost of individual transformers and high-potential distributing mains with the three-wire system of mains at low potential, we do not find a great difference in first cost in favor of the alternating. We do find, however, that the Edison feeders for the same distance cost about thirty-one times as much as for alternating current at 1,100 volts, 125 times as much at 2,200 volts, or 500 times as much at 4,400 volts. It would then appear that if we could apply alternating current to the feeders at high potential and transform down for the mains, we might reach the lower first cost of the ordinary alternating-current system and possibly retain all the best features of the direct current. To accomplish the former, the transformers must be provided at a small proportion of the cost of the alternating-

current feeder, and to do the latter, they must not increase the average losses in the system. It is obvious that we could with alternating-current move our station to any reasonable distance from our center of distribution, and at comparatively small additional cost for feeders. The whole problem then seems to come down to transformer efficiency and means of regulation.

To consider the matter of regulation first. We see at a glance that we cannot use the direct-current method of regulation by supplementary 'bus bars, but we can use the booster method, and can, moreover, apply a static booster to each feeder to regulate within any desired limits and with as small gradations as necessary. In fact, the booster method of regulation was first applied to alternating-current distribution, and operates with much less average consumption of energy than either the supplementary 'bus or direct-current booster method. In this important consideration, we can therefore improve on and simplify direct-current methods.

The means of regulation having been in this way provided for the feeders, it remains to be considered what we shall do to eliminate the effects of transformer drop. As we have determined on a secondary low-potential, three-wire distributing system of mains, we can altogether dispense with high-potential mains and limit the high potential to the feeders. If we do this, we can conveniently have the transformers of the same unit capacity as the feeders, and arrange each with its primary connected to its independent feeder and its secondary feeding into the three-wire mains. We know that the effects of our feeder drop are eliminated if we regulate by pressure wires from the feeder ends. In the same way the effect of our transformer drop may be eliminated by bringing pressure wires from the secondary terminals. The feeder drop and transformer drop therefore become one, and are cared for in the same way. We can even secure better general regulation than with the direct-current system, as we have a better form of feeder regulator and have eliminated the effects of transformer drop.

Now, to return to the transformer itself and its efficiency. It is evident that with this system the transformer capacity need be no greater than that required for maximum station load, instead of more than twice that amount or nearly equal to that required for the total number of lamps connected. This at once doubles the average load on our transformers, and raises the average efficiency. It also incidentally reduces the first cost of transformers in still greater proportion. We also know, however, that transformer efficiency at light loads is dependent on the iron loss, and that this is interdependent with regulation or drop. If we can increase the drop, we can decrease the iron loss, and thereby greatly increase the average efficiency. Having provided against any interference with the regulation of the system by the transformer drop, we can afford to increase that to the heating limit of the copper. In this way, a 100-kilowatt transformer can be built with an average efficiency of over 98 per cent. The entire transformer loss can, moreover, be more than made up by the less loss in feeders which we would naturally have with alternating current.

We have thus eliminated the two features in which the ordinary alternating-current system of distribution has been inferior to the direct current, and have provided means for obtaining better regulation and higher efficiency at a very much less cost of installation than with the direct-current system.

This system was conceived several years ago, and it has since been my good fortune to have an opportunity to install a system of this kind on a large scale which is now in very satisfactory operation. It is laid out exactly as a three-wire Edison system would be, except that there are no sub-feeders. A network of mains is planned as if for use with direct current. The feeders are all designed for a 110-kilowatt maximum load at 1,100 volts, and at each

feeder end is placed a 110-kilowatt transformer feeding into the three-wire network in the same manner and at the same points as with the direct-current system. The transformers are located in

dictated by the voltmeters and also to divide the load between transformers in any way desired as indicated by the feeder ammeters. It is possible to shift the entire load from one transformer and feeder to

stations certain feeders often become so overloaded that it is found necessary for their safety to put resistance in series with them to force some of the current to other feeders. The possibility of overloading any individual feeder beyond its share is absolutely provided against in the system described. To make the arrangement of this system perfectly clear it is illustrated diagrammatically in Fig. 2.

In Fig. 1 are shown four curves of station distribution efficiency. No. 1 is that of a representative Edison three-wire, direct-current station. No. 2 is the new alternating-current system described. No. 3 is the usual alternating-current system employing separate transformers for each customer or for adjacent customers, the best modern transformers being used. No. 4 shows the same system, but with the average transformers found on the lines of most existing stations. These curves were plotted from the following data obtained from actual practice:

	No. 1.	No. 2.	No. 3.	No. 4.
	Percent.	Percent.	Percent.	Percent.
Feeder loss.....	24	8	10	10
Main loss.....	2	2	2	2
House wiring loss...	1	1	1	1
Transformer loss, iron.....	..	.23	6	12
Transformer loss, copper.....	..	2.7	1	.5
Total loss at maximum station load,	27	13.93	20	25.5
Efficiency at maximum station load.	78.7	87.9	83.8	79.6

The efficiencies of distribution at assumed average loads are shown to be as follows:

	No. 1.	No. 2.	No. 3.	No. 4.
	Percent.	Percent.	Percent.	Percent.
Load, 25.....	94.1	95.8	78.4	66.6
Load, 20.....	94.8	96.2	75.3	61.4
Load, 15.....	96.1	96.5	70.3	54.3
Load, 10.....	97.8	96.4	61.9	45.1

At maximum load it will be noticed that the efficiency of alternating current No. 2 is ten per cent. higher than No. 1, the direct current. This means that the same energy can be delivered with ten per cent. less capacity in generators, engines and boilers, or a difference of ten per cent. in the first cost of generating plant. It is pertinent to remark here that alternating-current generators also have a much greater margin for overload for short periods than direct-current generators. The efficiency at average load, or the all-day efficiency of the No. 2 alternating-current system, is also shown to be appreciably higher than the direct-current. In large central stations the average load is generally found in practice to vary from about fifteen to twenty per cent. of the maximum, and it will be noted that from twelve per cent. average load up, No. 2 curve for the special system of alternating-current distribution shows a higher efficiency than the direct-current.

It may be asked what effect the aging or fatigue of the transformer iron will have on these figures. I answer, none appreciable. Transformer manufacturers are willing to guarantee as low as one per cent. increase per year in iron loss. This means one per cent. of the actual amount of energy lost in the iron, so that, if this increase continued at the same rate, it would take one hundred years to double the iron loss. Experiments tend to show, however, that this effect rapidly approaches a maximum, and that, therefore, the increase goes on at a constantly decreasing rate. The entire effect may be eliminated, if desired, about once in five years by reannealing the transformer iron at a very small expense.

It has been the practice in some European stations to out transformers during periods of light load, but it will be seen that outting out transformers in the system described would only decrease the efficiency; in fact, the efficiency is higher at about the average load, and the system was designed through-out to accomplish this result.

The less we say about curves Nos. 3 and 4 the

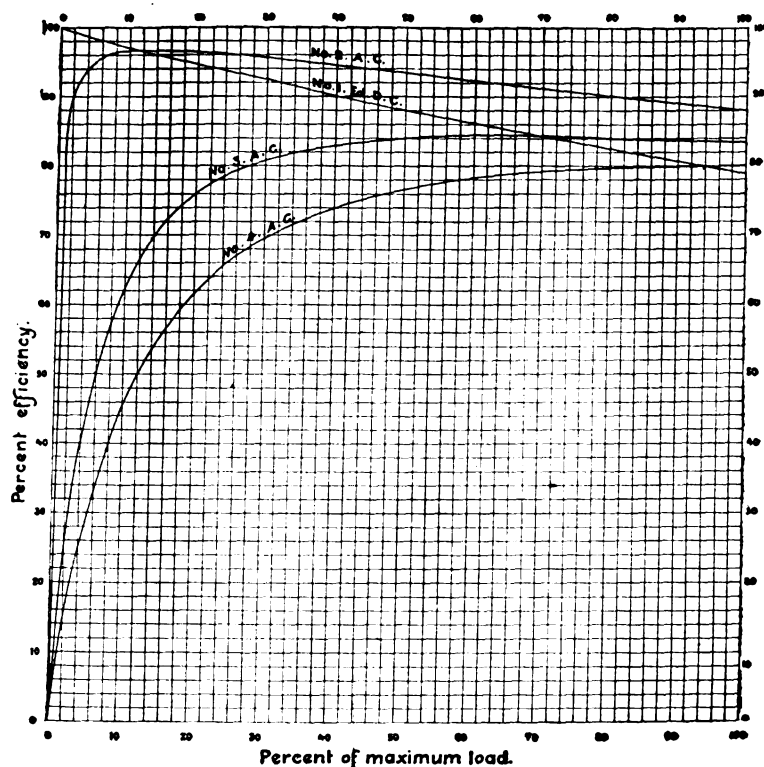


FIG. 1. CURVES OF DISTRIBUTION EFFICIENCY.

manholes of suitable design. From the secondary terminals of each transformer, pressure wires are run back to the station. Each feeder has an independent regulator by which the pressure can be

an adjacent transformer in this way without sensibly affecting the pressure on the system, and an equal division of load between transformers can be readily maintained at all times if desired. This is a

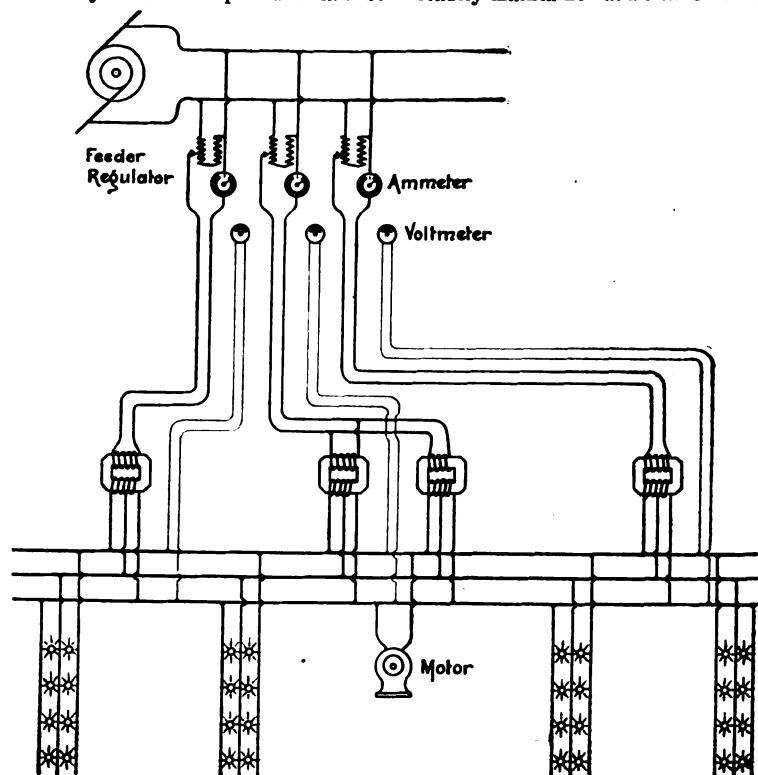


FIG. 2.- SINGLE PHASE A.C. SYSTEM

with High pressure Feeders and low pressure distribution.
Independent Feeder for each Transformer or Group.

raised or lowered. There are no primary mains, nor any connection whatever between the primary feeders. The regulators perform two functions. They are used to maintain the proper pressure as in-

very important consideration when very heavy loads or overloads are to be carried. The distribution of load on any large system is constantly changing as new customers are connected, and in large Edison

better, as at small loads the efficiency is shown to be appallingly low.

EXTENSIONS OF DIRECT-CURRENT SYSTEM BY ALTERNATING CURRENT.

Several large three-wire, direct-current Edison stations are beginning to employ alternating current to extend their lighting territory beyond that possible or profitable with low-tension current. This is a recognition of alternating current which would not have been considered for a moment a few years ago. They now propose to use alternating current to transmit their energy at high potential to a distant sub-station, where it will be transformed to a lower pressure and then again transformed by means of rotary transformers to direct current, which is in turn distributed over the three-wire Edison system as if generated in the ordinary way. This is a very beautiful and instructive application of alternating currents, and ingeniously designed machinery. It gives the manufacturers a chance to sell additional machinery, swells the company's real estate investment and gives work to the unemployed to operate the sub-stations.

The loss in the conversion to alternating current and back is about fifteen per cent. in addition to the loss in static transformers and lines. This distribution might be accomplished without the additional machinery, wire, real estate, labor and loss inefficiency. It is hardly to be expected, however, that those who have grown up under the protection or influence of direct current would use alternating current any further than absolutely necessary until they have grown more accustomed to the new mode of travel. After looking across the stream to coveted territory for many years, they are willing to use the new bridge and to ride across at about the highest speed provided, but when they get on the other side they are more than satisfied to foot it again the rest of the way.

A much higher efficiency of distribution, and better regulation, could be secured by using the alternating-current system as it is, without transformation to direct-current, and everything could be controlled from the main station without employing labor or apparatus at sub-stations. Why do they not use it so? They say that many things cannot be accomplished as well with alternating current. If that is a challenge, we will accept it and try conclusions with them. Let us then anticipate these various objections and see what they amount to.

FIRST, EFFICIENCY.

We have already seen how a properly designed system of distribution for alternating currents may be made to exceed the direct-current system in efficiency, taking the latter under its most favorable conditions. If we then add to the usual losses in the direct-current system the losses in double rotary transformation and in static transformers, the very great difference in favor of the alternating current is still more marked.

REGULATION.

It has been shown how very simple and reliable regulators can be provided for each alternating-current feeder, which will secure the closest possible regulation over any range desired, and this can be effected at a loss of less than one per cent. Such close regulation can only be secured with direct current by the use of a number of generators connected to auxiliary bus bars, or by connecting the feeder ends to adjustable resistance connected between the busses of two or more generators. The first cannot be realized in a rotary-transformer station, and the last is quite wasteful of energy. Regulators placed on the alternating-current feeders of the rotary transformers control alike the pressure on each rotary, and all the direct-current feeders supplied by the same, in exactly the same way as field regulation does on a direct-current generator. Such regulation can only be effectual with a number

of small rotaries not operated in multiple. The best regulation can, therefore, undoubtedly be secured with the alternating-current system.

OPERATION OF ARC LAMPS.

It seems now to be the universal opinion among Edison station men that the enclosed-arc long-burning lamp is destined to replace all the old forms of arc lamp. We will, therefore, consider this type of lamp only. Fully as well-burning lamps of this type are now made for alternating current. They are also about as free from noise as the direct-current lamps. Many will say, however, that it is impossible to get as much light from the alternating current as from direct current. That is true if we state that the same energy in the arc produces less light with alternating current than with direct current. It has been determined that the alternating-current arc produces about seventy per cent. of the light to be obtained from the same number of watts in the direct-current arc. The usual direct-current enclosed arc requires five amperes at 115 volts, or 575 watts. How much of this is used in the arc? Somewhat less than eighty volts, or under 400 watts; the balance of over 175 watts being wasted in resistance.

With alternating current, seventy per cent. of the amount of light would be obtained with this 400 watts, or about 570 watts would be required to produce the same light. The alternating-current arc is best operated at about seventy volts, but inductive resistance is used to bring the pressure down to this amount. This inductive resistance consumes about ten watts actual energy, making in all 580 watts, against 575 for the direct current for the same amount of light. This difference of five watts, or less than one per cent., is insignificant.

The standard alternating-current enclosed arc consumes about 420 watts at the lamp terminals, but I have had made to order a large number of 550-watt lamps which have replaced many series ten-ampere direct-current lamps. There are certain kinds of arc lighting to which the alternating current is particularly well adapted, of which I will speak later on.

(To be continued.)

THE DISTRIBUTION OF ELECTRICAL ENERGY IN PARIS.

BY J. LAFFARGUE.

(Concluded from page 378.)

Secteur de la Rive Gauche.—The company for the Sector de la Rive Gauche at Paris did not regularly commence to distribute electrical energy until January, 1896. Since that period the sector has considerably developed. This company distribute electrical energy over the whole of the left bank of the Seine. The works are situated outside Paris, at Issy, about 1 km. from it. The distribution is effected by alternating currents, with transformers installed in the premises of subscribers and at special sub-stations. The boiler-room comprises at the present time 10 boilers of the Crenot type, each capable of supplying 6,600 lbs. of steam per hour at the pressure of 170 lbs. per square inch. In the machine-room we find four horizontal compound Creusot steam engines of 700 HP. working at 125 revolutions per minute. A fifth similar engine is shortly to be installed. Each of these machines directly actuates a Ziperowski alternator of 400 KW. at 3,000 volts, with 40 inductor poles, and a frequency of 42 periods per minute. The continuous current exciting machines are two in number, of the six-pole Ganz form, yielding 70 KW. at 110 volts, with 200 revolutions per minute. These continuous current dynamos are worked directly by two horizontal compound single cylinder steam engines of 125 HP., working at 200

revolutions per minute. From the works start the feeders, laid in different directions.

The distribution is effected by Felten and Guillaume concentric cables insulated with paper and with jute, lead-enveloped and armored, laid directly in the earth. These cables were manufactured by the Société Industrielle des Téléphones. This sector is only beginning its work, but it has already a great number of prospective subscribers whose interior wiring is being proceeded with. On December 31, 1896, it numbered 44 cafés, utilizing 147 arc lamps and 2,636 incandescent lamps; 137 apartments, including 9,018 incandescent lamps; 126 shops and workshops, comprising 223 arc and 3,640 incandescent lamps; 19 establishments of various kinds, comprising 8,484 incandescent lamps, and 56 premises at the Halle aux Vins, comprising 516 incandescent lamps. In addition, there were 12 motors, of which six were for lifts and six for mechanical apparatus. On June 1, 1897, the total number of lamps supplied was 53,000. Amongst its principal subscribers the sector for the Rive Gauche includes the Sarbonne laboratories, which employ the continuous current. With this in view a special transformer station has been established. During the year 1896 the total amount of the electrical energy sold was 209,470 kilowatt hours for a sum of 232,261.65 francs. The mean selling price for the kilowatt hour was 10½d. The mean receipts per kilowatt installed was thus £14 13s., or 13s. 9d. per 10 candle lamp.

III.—POSITION OF THE PARIS DISTRIBUTING COMPANIES.

Such is the position in outline of the companies for the distribution of electrical energy in Paris. If we refer to the statistics worked out in 1896—for those of 1897 have not yet been published—we find the following results: The total power available at the works was 17,775 KW. from machinery and 1,610 from accumulators. For electric lighting 7,488 arc lamps and 417,468 incandescent lamps, corresponding to a total of 545,914 ten-candle lamps, representing an installed power of 21,840 KW. There were also to be numbered 300 electric motors, with a total power of 858 KW., for various purposes, and 220 motors, with 574 KW., for lifts; the total electrical power for force thus reached 1,432 KW. To this must be further added apparatus for electrical heating with a power of 6 KW. The total power utilized thus reached 23,276 KW. The mean prices charged for electrical energy at Paris are as follows:

	Price of KW. hour.	
	For	For
	light.	motive
	ing.	power.
	d.	d.
Municipal works at the Halles.....	10.0	5.76
Continental Edison Company.....	10.3	3.84
Société d'Éclairage et de Force.....	10.0	3.84
Compagnie Parisienne de l'Air Comprimé	10.9	4.8
Sector of the Place Clichy.....	10.7	4.8
Compagnie, Secteur des Champs Élysées.	12.2	5.76
Sector of the Rive Gauche.....	9.3	3.84

The present concessions will expire in 1906 and in 1907. The Municipal Council of Paris has latterly given much consideration to the conditions under which they may be prolonged. M. Charles Bos has made a special report on this subject. Without entering into all its details we will indicate some particular conditions: Electrical energy should be delivered at the price of 9.6d. per kilowatt hour for private lighting, and at the price of 4.8d. for public lighting. Electrical energy for motive power, heating and various uses should be paid at the rate of 3.84d. per kilowatt hour. The charging of accumulators for automobile vehicles should be effected also at prices varying from 2.86d. to 1.53d. and upwards per kilowatt hour according to consumption. These various conditions have not yet been accepted and concessions are not extended. But it is probable that a solution will shortly be arrived at, so as to allow all the arrangements being made to ensure an abundant distribution of electrical energy in the interior of Paris during the Exposition of 1900.

ON THE ABUSE OF POWER HOUSES.*

BY W. H. PREECE, C. E., F. R. S.

There is a great tendency in the present day to multiply power houses—or central stations, as they are more frequently called—unnecessarily. This arises from various causes: (1) from want of foresight in predicating the growth of electric industries; (2) economy in selecting the land we have, rather than pay money for land more suitable by position but which we have not; (3) the restriction of legislation in confining operations to a defined area; (4) the growth of other industries side by side, especially tramways and railways worked by electric traction.

These causes have led to the original power houses being designed too small and on space too confined; and to the subsequent construction of other power houses, further afield and more extended, and even to the necessity of going to positions outside of the original area secured by provisional order. But worse than this, different industries have been promoted by rival and opposing interests. Trade competition and patent rights have led to the construction of power houses side by side, until we see the absurdity of one installation being worked at night to supply energy for electric light and another installation generating energy during the day for traction purposes being built practically on the same site; whereas not only can the power be generated conveniently and economically by the same plant, but the two energies can mutually assist each other, so as to reduce considerably the work cost per unit generated. This is what the author means by the abuse of power houses. The man who causes two blades of grass to grow where one only grew before is called a benefactor, but the local authority which deliberately allows two power houses to be built where only one is needed is a disturber of the peace.

It is very well affirmed by experience that the greater the plant and the larger and more continuous the output the cheaper is the cost of generation per unit. It may be said roughly, that if a given plant—say, 10,000 kW.—working at its maximum load on the average three hours a day, produces electrical energy at one penny a unit, it will do so at three farthings per unit if it works six hours a day, one-half penny per unit if it works 12 hours per day and less than one farthing per unit if it works 24 hours the day; hence, concentration of power is distinctly financially desirable if it has the effect of lengthening the daily maximum output of the plant. One large station, conveniently built on the water-side, where coal can be delivered alongside, by rail or sea, at its cheapest; where water is abundant and available for condensing; where ashes, clinkers and dirt are easily barged away; where we have one control and one staff, is clearly the ideal power house for economy. And it puts a stop to any cause of nuisance. The cartage of coal and rubbish does not impede traffic. Vapor clouds do not offend the eye, and apparent rain, in the form of condensed drops of water, does not damage one's garment or need the raising of umbrellas; vibration, noise and smells cease to be causes of vexation and litigation; additional chimneys do not disfigure the view. The question of securing a site is very much simplified. Hence comfort and convenience attest the value of the concentration of power plant in one locality.

In these days of high electrical pressure, whether continuous or alternating, the position of the power house is not a matter of serious import. In the early days of the new electrical industry it was a question of economy of distribution to place the working plant in the center of the area to be served, but now it is of little consequence where it is placed within a limit of a few miles.

The whole tendency of recent legislation has

*Paper read before the Incorporated Association of Municipal and County Engineers at a district meeting held at Yarmouth, Eng., June 11, 1893.

been to favor local authorities and to facilitate their acquisition or induce their acceptance of those municipal duties which include the conduct of industries which affect the whole community, like the supply of water, of light and of general locomotion. The success of the electric light industry in the hands of local authorities is beyond dispute, and some of our large cities are now taking up vigorously and with great spirit the working of their tramways by electric traction. The ultimate success must be the same.

These corporations, with their provisional order and their electric light installations, have already the legal powers and the means to supply electrical energy. This is their right, and a valuable property it is to them. No one contests their right to do it, but there are corporations who have not yet acquired the working of the trams in their localities, but who have the right and the means to supply energy, and in these cases the right to supply energy to tramways is contested. If it were to succeed, and the tramway companies allowed in all cases to build and work their own power houses, we should see the absurdity of two buildings existing where only one was needed, of two causes of nuisance perpetuated where none need exist, where the public would suffer from higher fares and the undertakers voluntarily accept the responsibility of generating their energy at a needless cost. The supply of energy to work the tramways would enable the undertakers to reduce the price per unit to the electric light users by probably 1d., while they could at the same time supply the tramway company, if such exist, as cheaply as the company can make it themselves. Moreover, when the time arrives for the local authorities to take over the tramways they would not be saddled with two power houses.

Teaching Through the Phonograph.

At the Philadelphia Electrical Exposition, the views of a number of prominent men on the accomplishments and possibilities of electricity are given by means of the phonograph, and many hundreds of persons, young and old, have been delightfully entertained in listening to these utterances which were recorded upon the cylinder as they fell from the lips of the authors. The following by Mayor Warwick of Philadelphia is one of these phonographic addresses:

"Electricity is the spirit of the earth, the air, the sea and the sky. It is everywhere in nature; it makes the dull insensate wire vibrate with living words. Man is beginning to bridle it, to control it, and to apply it to the common uses of life. The irresistible forces of the ocean tide and the rush of the mighty cataract are being used as the creative motive power for its distribution throughout the world. It annihilates time and distance, and is uniting the nations.

"If the phonograph had been known to the ancients, the Greek and the Latin tongues would not be dead, but living, and the speeches of the orators of the past—Demosthenes, Cicero and Hortensius—would be repeated, word for word, even showing the inflection of the voice, the articulation, emphasis and pronunciation of the words. A couplet of Wordsworth in which he writes, 'And Babylon hath perished utterly without in her speech leaving one word to aid the following that would lament her,' would then be out of form and place. Ancient languages of States long since departed, the civilization of which is marked only by crumbling ruins, would to-day speak a language as distinct in meaning and in phrase as any modern language of the earth.

"In commerce, in art, and in the everyday uses it is doing its work. The telephone, the telegraph, the phonograph and the kinesiograph are comparatively modern inventions. No one can predict the future of this great force in the civilization of mankind. Galileo, Faraday, Franklin and Edison are

names that will always stand high in the record of fame and add to the glory of mankind."

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The Fifteenth General Meeting of the American Institute of Electrical Engineers is now being held in Omaha, Neb. The meeting was called to order at 10 A. M. on Monday, June 27, and an inaugural address delivered by the President, Dr. A. E. Kennelly of Philadelphia. Daily sessions are being held at 10 A. M. at which the following papers will be read:

"The Dielectric Strength of Air." C. P. Steinmetz, of Schenectady, N. Y.

"Two-Wire Distributing Systems and Lamps at 220-240 Volts." John W. Howell, of Newark, N. J.

"A Capillary Electrometer for Electrical Measurements." Chas. F. Burgess, of Madison, Wis.

"Alternating Current Transformers from the Station Manager's Viewpoint." W. F. White, of Omaha, Neb.

"Some Phases of the Rapid Transit Problem." Albert H. Armstrong, of Schenectady, N. Y.

"Preliminary Report of Committee on Standardization." Dr. Francis B. Crocker, chairman.

"Power Transmission and Distribution for Railway Work." Ernst J. Berg, of Schenectady, N. Y.

"The Commutated Curve of a Composite-Wound Alternator." D. C. Jackson, of Madison, Wis.

"Some Tests with an Induction Generator." A. F. McKissick, of Auburn, Ala.

"The Evolution of the Line Signal." Arthur V. Abbott, of Chicago.

"Alternate Current Working for Laboratory and Testing Purposes." Harris J. Ryan, of Ithaca.

"High-Voltage Power Transmission." Charles F. Scott, of Pittsburgh, Pa.

"The Education of Electrical Apprentices and Journeymen." Arthur A. Hamersohlag, of New York City.

"Air Gap and Core Distribution—The Magnetic Flux and Its Effect upon Regulation and Efficiency of Dynamo Electric Machinery." W. E. Goldsborough, of Lafayette, Ind.

"The Graphical Treatment of Alternating Currents in Branching Circuits, with Special Reference to the Case of Variable Frequency." Dr. H. T. Eddy, of Minneapolis, Minn.

"The Imperial Electric Light, Heat and Power Plant of St. Louis." George A. Damon, of Chicago.

Canadian Electrical Association.

The Canadian Electrical Association held its annual meeting at the Windsor Hotel, Montreal, on June 23. The following papers were read:

"How to Overcome Some of the Difficulties Encountered by Central Station Men." A. A. Wright.

"The Quimby Screw Pump." W. T. Bonner.

"Experiences of an Inspector." Dr. J. K. Johnstone.

"The Electric Current in the Rainy River Gold Mines." F. A. Bowman.

"Electric Utilization of Water Powers." Louis De Witt Magie.

"Economies in the Boiler Room." James Milne.

"The Unconscious Ownership of an Important Key—A Plea for the Introduction of Goods Traffic on Our Suburban Tramways." W. T. Bonner.

The General Electric Company will owe on July 1, 1893, \$1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

The Electrical Railway Equipment Company, a Virginia corporation, has filed suit in Washington against the Metropolitan Railway Company and the Capital Traction Company, asking for an injunction and an accounting. The plaintiff sets forth in the bill that it is the owner of a certain patent of a current collector for electric railways, invented by Frederick A. Anderson, and variously transferred until it is now held by the plaintiff company. It charges that both of the railway companies named are using in the underground electric systems operated in Washington a current collector of exactly the same design and pattern as that upon which the complainant holds the patent.

Judge Townsend, in the United States Court at New Haven, Conn., on the 20th inst., dismissed the bill of the Perkins Electric Switch Manufacturing Company against the Gibbs Electric Manufacturing Company alleging infringement of the form of an electric switch known as a snap switch.

Justice Lambert has appointed Albert C. Emmerick receiver of the Buffalo, Kenmore & Tonawanda Electric Railway Company. The appointment was made on application by Rogers, Looke & Milburn, attorneys for the Fidelity Trust & Guaranty Company, which holds a \$55,000 mortgage on which the company has defaulted.

Judge Lacombe in the U. S. Circuit Court handed down a decision on the 25th inst., granting a preliminary injunction in the case of the Sprague Electric Railway & Motor Company against the Nassau Electric Railroad Company of Brooklyn, N. Y., restraining the latter from using a car motor which is claimed to be an infringement of a patent obtained by Frank J. Sprague in 1885 and described in the specifications as "the combination of a wheeled vehicle and an electric dynamic motor mounted upon and propelling the same, the field magnet of said motor being sleeved upon an axle of the vehicle at one end and supported by flexible connections from the body of the vehicle at the other end." The defendant is ordered by the decision to remove at least 250 of the infringing apparatus within thirty days, and at least 250 more within sixty days, and the balance within 120 days from date of decision.

The Connecticut Supreme Court of Errors, in the case of the New York, New Haven & Hartford Railroad Company against the Fair Haven & Westville Railway Company (electric) has decided in favor of the steam road, holding that the latter is entitled to damages for the crossing of its tracks at grade on Bridge street, New Haven, by the trolley. Since this suit was begun the Legislature has passed a law prohibiting the establishing of any more grade crossings of steam and electric roads.

The attorneys for the Richmond Railway & Electric Company and the vice-president of the company, George E. Fisher, on the 21st inst., at Baltimore, secured an order from Judge Harlan of the Court of Common Pleas removing to the United States Circuit Court two suits docketed by the Virginia Electric Company of Baltimore to recover \$500,000 upon an alleged violation of contract to develop water power in Virginia from the James River.

Howard A. Engle, Dillwyn P. Roberts and W. Howard Holden, on behalf of themselves and the Penn Insulated Wire Company, at Philadelphia on the 20th inst. filed an answer in the Common Pleas Court to the equity suit recently begun by Albert Foulds to have a receiver appointed for the company. The Penn Insulated Wire Company is a New Jersey corporation, with a capital stock of \$150,000, divided into shares of \$25 each, and is engaged in the manufacture of all kinds of insulated wire, cables, paper tapes and insulated compounds for electrical purposes. Mr. Foulds recovered a judgment against the company on October 16, 1896, and issued a writ of fieri facias, which was returned nulla bona, and no part of the judgment was ever paid. Mr. Foulds then brought his suit, alleging that the defendant company has no assets except stock subscriptions, and that by reason of their stock subscriptions each individual defendant became liable to pay to the

company \$15,625. He believes, however, that they have paid in less than 5 per cent. of the amount, and avers that the board of directors has failed to call in the balance due on said stock subscriptions. He asked that a receiver be appointed; that the individual defendants pay the receiver the amounts due by each of them, and that his claim be satisfied out of the moneys so paid in. In the answer filed as above the defendants say that all of the stockholders of the company are not made defendants; that the bill contemplates an entire winding up and settlement of the affairs of the company, and that the court has no jurisdiction to entertain a bill to that effect, and that an assessment or calls upon the holders of stock can only be made by the directors of the company or by virtue of a decree of the Court of Chancery of the State of New Jersey.

In the cases of the Edison Electric Light Company against the Minneapolis International Electric Company and the Thomson-Houston Electric Company against the Minneapolis International Electric Company, before Judge Loohren of the United States District Court at Minneapolis, it was decided that the defendants were in no way connected with the E. G. Bernard Company, which was enjoined from manufacturing apparatus infringing on the complainants' patents, and that the defendant's demurrer is sustained. The Minneapolis company is therefore free to continue the use of the apparatus in question.

CANADIAN NOTES.

It is said that the Grand Trunk Railway authorities have not yet come to any definite conclusion regarding the adoption of electricity for hauling trains through the Sarnia tunnel.

The new copper wire of the Canadian Pacific Telegraph Company, in course of construction from coast to coast, was completed between Montreal and Winnipeg last week. The new line gives the Canadian Pacific Company greatly increased facilities between the Atlantic coast and the city of Winnipeg, Man.

The report of Mr. James Milne, the electrical expert employed by the city of Toronto to make a report on the cost of an electric power supply for street lighting and commercial purposes for Toronto, is against the city erecting a commercial plant. The expert reports that the data received from users of both electric and steam power is not to be absolutely relied on for the purposes of careful calculations, owing to the different bases upon which the various returns have been prepared. The summary of steam users shows a consumption of 16,802 horse-power, from which may be deducted 10,000 horse-power for the Toronto Electric Railway Company, electric light and incandescent light companies' plants, leaving 6,802 horse-power for commercial purposes. Of this amount, he says, nearly 1,000 horse-power could be supplied by electric power or gas as cheaply as at present, but for the remaining 5,809 horse-power it is useless trying to persuade the manufacturers to change from their present methods.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Bellaire, O.—The citizens have voted to issue bonds for the purpose of establishing an electric light plant.

Chamberlain, S. D.—The strong flow of water struck in the Government artesian well at the Indian School has suggested to the superintendent the use of the water for power purposes in operating an electric light plant, in irrigation, etc.

Detroit, Mich.—The Peninsular Electric Light Company has been reorganized with a capital stock of \$150,000. The principal stockholders are David Whitney, Jr., George Peck, James E. Clough, Hoyt Post, S. J. Murphy and S. Dow Elwood. Other stockholders are J. L. Hudson, George Wiley, Robert McMillan and Alex. Dow. The first board of directors are Messrs. Peck, Whitney, Dow, Clough and Post.

Elkton, Mich.—An electric light plant is to be established here.

Escanaba, Mich.—In 1895 this city purchased the local lighting plant, the price being \$70,000, which was

to be paid in ten annual installments. This year's payment has not yet been made, although due on June 1, the mayor having refused to sign the order for the money, and the plant may now revert to the former owners under the conditions of the contract. If it does the city will lose the three payments already made on the plant.

Hagerstown, Md.—President Christian W. Lynch of the Hagerstown Electric Railway Company has submitted a proposition to the street commissioners to furnish 90 arc lights to the city for \$7,000 a year if given a ten-year contract. At present the city is paying \$6,000 for 80 arc lights.

Kansas City, Mo.—An ordinance granting to C. S. Sweetland and E. J. Ingraham the right to construct and operate an electric plant for the furnishing of light, heat and power to consumers in Kansas City has been introduced in the upper house of the council. The petitioners offer a large reduction on present rates, 2 per cent. of the gross earnings to go to the city, and the right to purchase the plant in twelve years by the city at a fair valuation. The term of the franchise asked for is thirty years.

Lebanon, O.—This town has voted to buy its electric light plant, now owned by a private citizen, for \$20,000.

Nanticoke, Pa.—The People's Electric Light, Heat & Power Company, which has just been chartered, will acquire the Nanticoke Electric and Nanticoke Gas Companies' properties and conduct the business of both with a view to more amicable and economical operation.

New Orleans.—The committee on lighting has determined to advertise for bids for lighting the town with electricity for ten years from the expiration of the present contract in 1902.

Petoskey, Mich.—At the recent election the voters decided to bond the town for \$16,000 to buy the Petoskey Edison Electric Light Works of H. O. Rose.

Perkasie, Pa.—The Philadelphians, Ettinger & Co., who were granted a franchise to operate an electric light plant by the borough council, have forfeited their right. Perkasie and Sellersville may unite in building a plant to light the two towns.

Salem, Pa.—The electric light plant of the Heat & Power Company of this city was sold at public sale on the 26th inst. It was purchased on behalf of the directors of the company by Thomas Sinnickson, Jr., the consideration being \$5,000.

Salt Lake, Utah.—The Utah Power Company is about to enter the lighting field in competition with the Union Light & Power Company.

San Francisco, Cal.—The petition of the Mutual Electric Light Company for an order vacating the contract for public lighting awarded to the San Francisco Gas & Electric Company, after argument before Judge Seawell was taken under advisement by the court.

Spartanburg, S. C.—By order of the Circuit Court, the plant of the Etna Light & Power Company of this city, which has been in the hands of receivers since last November, is to be sold the first Monday in August. The receivers, A. H. Leftwich and H. B. Carlisle, are authorized to make the sale.

West Bay City, Mich.—Bids will be received up to the evening of July 7 for an incandescent 45 kw. dynamo for the city lighting station. The bids also call for an exciter, rheostat, voltmeter, ampere meter and double pole switch.

STREET RAILWAYS.

Ashtabula, O.—The board of county commissioners of Lake county has granted to the Pennsylvania & Ohio Railroad Company a fifty-year franchise to build and operate an electric street car line to extend east from Painesville, via North Ridge, Middle Ridge and Narrows road, to the east line of Lake county. The company is required to furnish a \$20,000 bond to have the road built and in operation by July 1, 1900. Ashtabula county has already granted a franchise to the same company and the franchise granted in Lake county insures a continuous street line from Cleveland to Ashtabula.

Atlantic City, N. J.—An ordinance has been introduced in council giving the New Jersey Electrical Railroad Company the right to build an elevated roadbed into the city from the city limits. The company contemplates building a railroad from Camden to Atlantic City.

Brooklyn, N. Y.—President Frederick Uhlmann of the Brooklyn Elevated Railroad announces that the Fifth avenue branch of the road will be electrically equipped with the third-rail system this fall. As soon as this line is opened the work of electrically equipping the other lines of the company will be pushed, and in two years from the commencement of the work, according to the present programme of the managers, the entire road will be operated by electricity.

Burlington, Vt.—The "News" says there is a good prospect that the electric railway from Bethel to Rochester will be built.

Chicago.—The Chicago Electric Traction Company has been granted a twenty-year franchise to operate a trolley line in the town of Worth to the Calumet and Mount Olivet cemeteries.

Chattanooga, Tenn.—The Chattanooga Rapid Transit Company is experimenting with a Patton motor car

with a view to adopting that system if it proves satisfactory.

Cleveland, O.—The suburban electric railway companies have received notices from the express companies that after July 1 the latter would withdraw their messengers and handle no more express matter on suburban cars. The move is understood to be in the interest and at the dictation of the steam railroads, and the street railway people propose to form an association and handle the express matter themselves.

Du Bois, Pa.—Eastern capitalists are considering the feasibility of constructing an electric railway from Clarion to Du Bois, passing through Strattonville, Corsica, Brookville, Emericksville, Reynoldsville and Rathmel.

Fairmount, W. Va.—An effort is being made to secure sufficient local subscriptions to the stock of the proposed electric railway from Monongah to Fairview to warrant the promoters and capitalists interested in proceeding with the work.

Frederick, Md.—A deal has been made between the Myersville & Catoctin Electric Railway Company and the Frederick & Middletown Electric Railway Company whereby the latter will lease the former company's line when it is finished and operate it along with its own line.

Framingham, Mass.—The bill to incorporate the Marlboro, Southboro and Framingham Street Railway Company has passed both branches of the Legislature, and this being the case it should soon be possible to travel from Worcester to Boston by trolley.

Fort Scott, Kan.—The Davenport, Ia., owners of the street railway lines in this city, for a consideration of \$180,000, have deeded the entire plant to the Citizens' Railway Company, composed of Fort Scott men. The change in management has already taken place.

Hackensack, N. J.—The Bergen County Traction Company has completed the survey for the route from Leonia to Hackensack, and work on the construction will begin at once.

Mt. Holly, N. J.—The fight between the rival trolley companies in Burlington county is to be renewed at the next meeting of the board of freeholders. For some time past, the representatives of the two corporations—the New York & Philadelphia and Monmouth Companies—have been trying to pool their issues and effect either a consolidation or a division of the disputed territory, but a few days ago all negotiations were declared off, and it will now be a fight to a finish.

Neenah, Wis.—It is rumored that several of the city's monied men are having a street railway franchise prepared and will present it to council in a few days. There seems to be no doubt of the favorable action of council when the matter is brought before it.

Newport, R. I.—The electric railway between Newport and Fall River has been opened for public traffic. The Providence "Telegram" says the construction of the line is undoubtedly the best in New England; the tracks heavy and delightful to ride over; the cars almost like palace cars, with plenty of room, and the overhead work a model of wire system.

Norfolk, Va.—It is understood that a deal has been consummated by which three local trolley companies have been consolidated. The companies are the Norfolk Street Railway Company, the Norfolk & Ocean View Railroad Company and the Norfolk, Willoughby Spit and Old Point Railway Company. The deal was arranged by F. Lancaster Williams of Richmond.

Sandusky, O.—Clark Rude, receiver of the Sandusky Street Railway Company, advises that he will sell in Sandusky on the 9th of July, by order of the Court of Common Pleas, all the property, rights, privileges and franchises of that company, of which Rollin B. Hubbard and Jay O. Moss are trustees.

Washington, D. C.—Mr. Richardson has introduced a bill in the House providing that the Capital Railway Company of this city be authorized to change its name to Washington City Railway Company.

Westminster, Mass.—The Westminster & Fitchburg Street Railway Company has petitioned the selectmen for a re-location of franchise in this town, and the hearing will be held July 5.

Wichita, Kan.—At a recent meeting of the city council Mr. Reese, chairman of the street railway and franchise committee, reported that he had received a letter from an Eastern party who he felt certain would take hold of the street car line here and build a first-class road, fully equipped, providing he received a lighting franchise for a term of years. B. A. Ward, manager of the Wichita Gas, Electric Light & Power Company, has made a similar offer.

TRANSMISSION PLANTS.

Utica, N. Y.—The "Observer" states that the company which proposes to utilize the waters of West Canada Creek in generating electricity has been organized under the name of the Newport Electric Light & Power Company. Its operations at present will be limited to supplying the village of Newport with light and power, but a dam is to be built which will give about 4,000 horse-power, enabling the company to furnish electricity to several villages in the neighborhood, and for the operation of an electric road. Eventually power will be transmitted to Utica, a distance of about 13½ miles.

MANUFACTURING, ETC.

Baton Rouge, La.—A bill has been introduced in the House which provides that for conducting the business of supplying electric lights, or electric power, renting or hiring motors, fans, or other electric appliances or machines, each company shall pay an annual license of \$5 upon each \$1,000 of gross receipts from such business.

Bridgeport, Conn.—The Bryant Electric Company is erecting an engine room in rear of its factory which with its equipment will cost over \$12,000. The "News" says the company intends to have nothing but the most improved patterns in boilers, engines and dynamos and is sparing no money in its effort to procure the best obtainable.

Denver, Col.—The Colorado Gilsonite Company, who are developing the gilsonite deposits in Middle Park, have begun regular shipments from Empire, to which the crude material has to be hauled 54 miles from the mines. The company has made arrangements to ship 20 tons a day and already has contracts for the delivery of 4,500 tons to manufacturing establishments in the East. The principal use to which gilsonite is devoted is the manufacture of water-proof paint. It is used to paint the bottoms of iron ships, not only preventing the corrosion of the metal and reducing the friction of the water, but lessening the difficulties resulting from the fouling of the bottoms with barnacles and seaweed. It is also used for painting the faces of sea walls, preserving the stone from the action of the water, and for treating the timbers used for piling to prevent their destruction by the teredo, for coating fence wire, for insulating electric wire and for a number of other purposes.

New York.—The strike in the shops of the Bullock Electric Company at Cincinnati, which has been going on for several weeks, has extended to this city, where the International Association of Machinists has taken up the cause of the strikers and is obstructing the operations of the company. The Bullock Company has applied to the courts for relief.

Victor, N. Y.—The firm of F. M. Locke & Co., manufacturers of porcelain insulators and insulation pins, have determined to establish a factory here, sufficient inducement having been offered. Recent tests made of the earth about Victor showed that it was of the description necessary for the manufacture of the grade of porcelain required.

Washington, D. C.—The District Appropriation bill has been reported to the House, containing, among others, the following items: For the complete equipment of the central stations of the fire alarm system, including provision for thirty box circuits and ten alarm circuits, equipped with all modern appliances, to take the place of the present system, \$21,500; necessary cabinet work for mounting the same, \$3,000; storage battery system, to take the place of the gravity battery system now in use, \$3,500; replacing sixty old fire alarm boxes which have been worn out with sixty new modern boxes, \$8,000; placing in eighty boxes standard cut-outs, to prevent their being destroyed by lightning or other electrical disturbances, \$1,000; for twenty visual indicators, to be placed in the engine houses for recording visually alarms received, to prevent any errors in responding to fires, \$2,500; in all, \$37,500.—Hugo Donzelman, U. S. Consul at Prague, writes that "Bohemia, being the most productive State of the Austrian Empire, will gradually but surely advance in internal improvements. So far but little has been done, and the field is open; especially is this the case with electric roads, elevators and electric lights. There are in my district a number of electric street car lines projected, and I believe that with the proper effort United States contractors could successfully compete in this line; at least our firms could furnish the necessary machinery. The horse-car line now in Prague is to be changed into an electric line and to be extended. The city of Pilsen will also construct electric lines. I would suggest that our manufacturers take steps to investigate the possibility of getting their share of this business. I think that some one thoroughly conversant with this line should visit the various places, in order to be able to give figures and offer bids."

MINES.

O'Fallon, Ill.—The management of the Bennet mine is making preparations to install a system of electric haulage. Electric lights will also be added.

ELECTRICIANS IN THE WAR.

Joseph Steinmetz has been appointed First Lieutenant in the First Volunteer Engineer Regiment.

PERSONAL AND MISCELLANEA.

Charles S. Bidwell, until recently superintendent of the Warren (O.) electric lines, has accepted an important position with the company operating the railway from Asbury Park to Pleasure Bay, N. J.

Frank A. Phillips, an electrician of Brooklyn, N. Y., was drowned in the Hudson River, near New York City, on Saturday last. A sloop yacht in which he and others were sailing was capsized by a squall. All were rescued but Phillips.

Information has been received at Louisville, Ky., that Lieutenant William W. Harts, United States Army, who was injured by a premature explosion of a torpedo near Jacksonville, Fla., has been left deaf and blind from the shock. He is now in the Marine Hospital at

Jacksonville. J. J. O'Rourke, an electrician, and an assistant were killed by the explosion that caused Lieut. Harts' injuries.

D. O. Hull, electrician of the Port Clinton (O.) Light & Power Company, has secured a patent for "an alternating current regulator and alternating arc light system," which the local journals say has been pronounced a success by electrical experts. "This invention," says the Oak Harbor "Press," "makes it possible to run arc lights from an alternating incandescent dynamo independent of transformers and incandescent lights, reducing cost of construction and using and requiring only one dynamo, doing away with the service of an arc light machine."

The Chillicothe Street Railroad Company has discharged all its male conductors and placed women conductors on its cars. The women selected for this service are said to be all quite good-looking, as only those of "fine personal appearance" have any chance of getting the job. It is reported that the receipts of the road have increased since the change was made, owing to an influx of visitors from adjoining towns, principally from the ranks of the slighted sex.

RECENT COMPANY ELECTIONS.

Consolidated Car Heating Company, Albany, N. Y.—The old board of directors was re-elected with the exception of A. S. Hatch of New York who gives way for Hon. James W. Hinckley of New York.

Passaic & Newark Electric Traction Company, Passaic, N. J.—Directors: Bird W. Spencer, George W. Waite, Frank M. Stillman, William G. Shaller, William J. Davis, Percy Ingalls and John F. McArthur.

Siemens & Halske Electric Company of America, Chicago, Ill.—President, Charles E. Yerkes; secretary and treasurer, W. T. Block; assistant secretary and assistant treasurer, C. F. Marlow; general manager, B. W. Grist; directors: Charles T. Yerkes, Martin Maloney, John E. Bartlett, R. S. Grant, Charles E. Yerkes, E. A. Moore, B. W. Grist, Howland Colt, W. L. Elkins, Jr.

Metropolitan Street Railway Company, Kansas City, Mo.—President and treasurer, C. F. Morse; vice-president and general manager, W. H. Holmes; assistant general manager and general superintendent, C. F. Holmes; secretary, L. C. Krauthoff; assistant secretary and assistant treasurer, J. A. Hardee; directors: C. F. Morse, C. B. Armour, C. F. Adams, of Boston; W. H. Holmes, C. F. Holmes, Wallace Pratt, P. A. Valentine, of Chicago; L. E. James and Chester A. Snider, Kansas City.

Suffield & East Granby Street Railway Company, Suffield, Conn.—President, E. A. Fuller; secretary, George P. McLean; treasurer, Edmund Halladay.

Vermont Electric Company, Burlington, Vt.—President, A. E. Richardson; vice-president, Edward A. Pope; secretary and treasurer, A. C. Whiting; manager, Walter S. Vincent.

Wilmington & Brandywine Springs Electric Railway Company, Wilmington, Del.—President, Robert C. Justice; secretary and treasurer, Dr. L. H. Ball; general manager, Richard W. Crooks; directors: Joseph H. Coates, George W. Atmore and the officers.

COMMERCIAL PARAGRAPHS.

A New Belt Dressing.

There has been a growing demand among belt users for a more convenient form of belt dressing than the paste. The Joseph Dixon Crucible Company, Jersey City, N. J., are now placing on the market a solid belt dressing in round bars, about 8 inches long and 2 inches diameter. It makes a package convenient to the hand, and easy to apply even to fast running belts. The company does not claim that the solid dressing is as good a preservative of the life and elasticity of the leather as the Dixon paste, but it is quick to apply and quick to act, and that is what is wanted by the general run of belt users.

The Corrugated Copper Gaskets manufactured by the U. S. Mineral Wool Company, No. 6 Cortlandt street, New York, are rapidly coming into favor and displacing all other kinds heretofore in use. The advantages of this make of gasket are readily seen on examination. The gaskets consist of thin sheet copper stamped with concentric corrugations and may be used in place of rubber or other destructible materials in general packing. Three to six corrugations are all that are necessary, so that the space within the bolt holes usually determines the width of the gasket. In cases where the flanges are thin, and for this reason liable to bend when the bolts are tightened, it is advisable to extend the copper gasket to the full width of flange. This will, of course, require the cutting of bolt holes in the gasket. Connections made with these gaskets will not blow out after continued use, for each corrugation makes the entire circle of the flange, and so long as the contact is kept complete by compression the joint cannot leak. This gasket never blows out like rubber. It may be put in place while steam is leaking through valve, and it answers well on pipes in which steam is alternately on and off, for it is not impaired by the repeated expansion and contraction. These corrugated copper gaskets are said to be superior to all other devices for lip unions, flange unions, plain and ball joints, connecting steam, air, gas or water pipes; also for cylinder heads, steam chests, etc. The prices at which they are offered are very reasonable. A price list will be furnished by the company on application.

INCORPORATIONS.

The Orange & Passaic Valley Railway Company, Newark, N. J. Capital stock, \$1,000,000. Incorporators: Ohas. A. Sterling, of East Orange; William Scheerer and John A. Ely, of Orange; Albert B. Carlton, of Elizabeth, and Bird W. Spencer and Thomas M. Moore, of Passaic.

The Seattle Gas & Electric Company, Seattle, Wash. Capital stock, \$1,000,000.

The Oshkosh-Omro-Berlin Electric Railway Construction Company, Oshkosh, Wis.—to build an electric road to connect the places mentioned in the title. Capital stock, \$25,000. Incorporators: J. A. Jenkins, S. W. Hollister, John Hinebaugh, Nathan Payne, Jay Hume, W. J. Wagstaff, R. C. Russell, A. B. Ideson and Charles Barber.

The Columbia Traction, Light & Power Company, Columbia, S. C.—to buy and own the entire street railway system and electric lighting plant in Columbia. Capital stock, \$500,000. Incorporators: I. L. Withers and F. H. Weston, of Columbia; F. F. Williams and Willet Hazard, of Buffalo, N. Y.

The Rockford Electric Light & Power Company, Rockford, Ill. Capital stock, \$50,000. Incorporators: F. M. Ellis, W. E. Dewey and C. F. Warner.

The Bloomington & Normal Street Railway Company, Bloomington, Ill. Capital stock, \$250,000, one-half of which is represented by A. E. DeMange and the other half by John Graham.

The People's Electric Light, Heat & Power Company, Nanticoke, Luzerne County, Pa. Capital stock, \$75,000.

The Eberle Construction Company, New York City—to construct and equip railways to be operated by electricity and steam. Capital stock, \$4,000. Directors: David Longecker and Charles R. Eberle of Philadelphia, Edwin C. Stout, Alva Oatman and Thomas A. Matthews of New York City.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JUNE 21, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

603,970. Electromagnetic-Switch Railway. Addison Norman, Toronto, Canada. Filed July 3, 1897.

606,156. Device for Attaching Fenders to Cars. Christian Sauerbrey, Owego, N. Y., assignor of one-half to Theodore D. Gere, same place. Filed Oct. 4, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

606,108. Electric-Arc Lamp. Frederic Wright, Newburg, N. Y. Filed Oct. 7, 1897.

606,127. Electrode for Arc-Lights. Charles S. Dolley, Philadelphia, Pa., assignor of one-half to Howard T. Goodwin, same place. Filed Nov. 21, 1896.

ELECTRICAL MACHINERY AND APPARATUS.

603,850. Electric Motor. Frederick E. Briner, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, same place. Filed Aug. 21, 1897.

605,862. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed May 20, 1897.

635,915. Electric Clock-Controlled Switch Mechanism. Robert W. Rollins, Hartford, Conn. Filed Sept. 27, 1897.

605,919. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed June 24, 1897.

605,953. Controlling Mechanism for Electric Motors. George Gibbs, Warren S. Johnson and Henry Winkler, Milwaukee, Wis. Filed May 10, 1897.

603,007. Composing-Machine for Type-Casting and Setting-Machines. George A. Goodson, Minneapolis, Minn. Filed Sept. 27, 1897.

605,009. Electric Controller. Marshall W. Banks, Madison, Wis. Filed Dec. 17, 1897.

606,012. Electric-Current Controller. John J. Hogan, New Haven, Conn., assignor of one-fourth to Thomas W. Corbett, same place. Filed July 15, 1897.

606,015. System of Electrical Distribution and Regulation. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Feb. 10, 1898.

606,033. Means for Compensating for Temperature Resistance-Changes. Charles F. Scott, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed Jan. 21, 1898.

603,036. Alternating-Current Electric Motor. Robert H. Hassler, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Sept. 6, 1895.

606,076. Electric Alarm System. Albert Ovenden, Akron, Ohio. Filed Sept. 24, 1897.

606,167. Electric Brake. Ernst W. G. C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 29, 1897.

606,171. Shunt for Electric Circuits. Oliver B. Shallenberger, Rochester, Pa.; Mary W. Shallenberger, executrix of said Oliver B. Shallenberger, deceased. Filed April 22, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

605,913. Telephone-Transmitter. Forest A. Ray, Boston, Mass. Filed Aug. 18, 1897.

606,162. Telephone-Exchange System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Feb. 6, 1897.

SIGNALS AND SIGNALING APPARATUS.

605,941. Electric Block-Signal System for Railways. Louis C. Werner, Broad Brook, Conn. Filed July 22, 1897.

013. Signal-Alarm. Frederick Bossert, Detroit, Mich., assignor of one-half to John E. F. Uthes, same place. Filed Dec. 6, 1897.

MISCELLANEOUS.

605,845. Electrolytic Production of Amalgams, etc. Emile Andreoli and Gabriel Andreoli, London, England. Filed Sept. 7, 1895.

605,842. Electrically-Heated Charge for Cartridges or Shells. Lindon W. Bates, Chicago, Ill. Filed June 30, 1896. Renewed Nov. 18, 1897.

605,928. Device for Metal Straightening and Cutting-Off Machines. Franklin B. Shuster, New Haven, Conn. Filed May 21, 1897.

606,143. Alarm-Clock. Frederick D. Hoehl, Pittsburg, Pa. Filed July 19, 1892.

TELEPHONE AND TELEGRAPH.

Association of Railway Telegraph Superintendents.

This Association met in Omaha, Neb., on the 15th inst., and elected the following officers for the ensuing year: President, W. W. Ryder, of the Chicago, Burlington & Quincy, Chicago; vice-president, L. B. Foley, of the Delaware, Lackawanna & Western, New York; secretary and treasurer, P. W. Drew, of the Wisconsin Central, Milwaukee. After the election of officers and the reading of committee reports, several interesting papers were read and discussed. The first was a paper on "Unnecessary Telegraphing on Railway Lines," by C. S. Rhoades of Indianapolis. K. Mackenzie of the Baltimore & Ohio next presented a paper on "Construction and Maintenance of Telegraph Lines Along Railways." E. A. Chenery of St. Louis read a paper on "Installation of Telephone Plants at Large Terminals," and the last topic, "Remarks on the Feasibility of Combining Telephone and Telegraph Circuits by Using the Same Wires," was introduced by C. Selden of the Baltimore & Ohio Railroad. On the 16th the meeting adjourned sine die after discussing a report made on the advantage of the use of low resistance relays on heavy railway wires, and the appointment of the following committees:

On Topics for Discussion at the Next Annual Meeting—J. S. Evans, Cleveland; H. C. Sprague, Kansas City; E. A. Chenery, St. Louis.

On Arrangements—W. F. Williams, Portsmouth, Va.; C. A. Dorton, Washington, D. C.; W. C. Walstrum, Roanoke, Va.

An informal reception was tendered to the Association on the evening of the 15th by J. J. Dickey at his residence. About 100 guests were present, and the company had the pleasure of listening to a concert in progress in a palm garden at Milwaukee, a number of long distance telephone receivers having been placed in the drawing-room for that purpose. The following is a list of the persons from abroad attending the meeting of the Association: C. F. Annett, wife and daughter, S. A. Mason, H. M. Sperry, W. W. Ryder and wife, Mrs. C. H. Bristol, Eugene W. Vogel, Chicago; Miss F. B. Terhune, Salt Lake; Mrs. M. B. Leonard, Richmond, Va.; J. B. Taltavall, New York; W. T. Williams and wife, Portsmouth, O.; Charles Selden and wife, Miss Imogene Selden, Baltimore; P. W. Drew and wife, Milwaukee; J. S. Evans and wife, Cleveland; Ed. Warner, Mrs. E. R. Warner, Jackson, Mich.

The next annual meeting will be held at Wilmington, N. C., July 19, 1899.

The New Orleans *Picayune* states that there is every indication that the new telephone company will begin work at an early day in that city. William P. Curtis, vice-president and general manager of the new company, has recently returned from Detroit, whither he had gone to hold a conference with the Detroit Telephone Company, whose system it is proposed to establish in New Orleans, and spoke to a *Picayune* representative hopefully of the prospects. He thought that when the proposition is actively canvassed in the city the minimum limit of subscribers will be speedily reached. Nearly 2,000 have already signed, and as the charges are only half of the Bell Company's rates, an early and large addition to the list is anticipated. Mr. Curtis is reported in the *Picayune* as saying: "The Bell Company have been flooding this town with all sorts of circulars, calling attention to the fact that they were the only people on earth, and that all other telephone companies were green-goods people and bunco-steerers, and warning every one to keep padlocks on their pockets when any other company but theirs came to town. You notice that this last circular, with one of which I have been favored, devotes its particular attention to the company which is coming here, and says all sorts of disparaging things about it. Well, all I can say from my recent trip to Detroit is this, even if the Bell people are the only ones on earth and entitled to an iron-clad monopoly of the telephone business, the new company is going to make them know that they are here, if they do them as they have done them in Detroit. The people who are putting in the new system here have a system in operation in that city, and they have about two 'phones to every one 'phone owned and operated by the Bell people. I sincerely believe that this town is ripe to get out of the clutches of the monopoly."

The Board of Fire Commissioners of Detroit, Mich., have instructed their secretary to correspond with telephone manufacturers with a view to getting estimates for the construction of an independent telephone line for the department. The appropriation of \$5,500 by the Board of Estimate for this purpose is thought to be sufficient to equip the department with 60 telephones of the improved make.

The Oregon Telephone Company, which has for some time been making preparations for closing up the gap in its long-distance service between Portland, Ore., and San Francisco, has now large gangs of men at work pushing the construction vigorously from each end. The completion of the line between Portland and San Francisco will

connect the long-distance systems of the Northwest and California, and make one system covering the whole Pacific coast, and forming one of the most extensive and complete long-distance telephone systems in the world. It will bring Portland in direct communication by telephone with every town of importance from Vancouver, B. C., on the north, to San Diego, Cal., on the south, and via Spokane and Boise City as far as Salt Lake City on the east.

The Franklin County Telephone & Telegraph Company was organized at Chambersburg, Pa., on the 21st inst., with a capital of \$40,000. A long distance telephone line will be built in town and over the county to compete with the Pennsylvania Company line now in operation. Enough subscribers are insured to make it a success. The following officers were elected: President, D. K. Appenzeller; secretary, H. B. McNulty; treasurer, Dr. David MacLay; advisory board: Hon. T. M. Mahon, D. L. Grove, Isaac Leasher, W. L. Minick, John C. Gerbig, Dr. J. O. Skinner; directors: Dr. R. W. Ramsey, A. N. Pomeroy, Alexander Stewart, H. E. Hultsizer, T. J. Kennedy, R. S. Smiley, A. S. Stover, W. C. Hull, John Zullinger, C. O. Gelwicks, Christian Brechbill. A charter has been applied for.

It is stated that the Bell company is getting the best of the fight at Three Rivers, Mich. The home company, it seems, got all the business people to agree not to use Bell phones, but the Bell people have secured such a large residence list that the merchants, in answer to demands, began to replace their old 'phones in their business places. The home company has put up a good fight, but as the field is limited, only one company can exist in the place and pay a profit on investment.

The telephone system is being largely extended in Japan, a survey having been completed for a proposed line between Tokyo and Osaka, upon which the work will soon be commenced. It is gratifying to know that a large number of orders for overland telephone cables have been placed with American firms.

The Magnetic Club of New York, composed of representatives of telegraphic lines, held their twenty eighth annual summer outing and dinner at College Point on the 22d inst. The day was thoroughly enjoyed by a large number of members, many coming from distant cities to meet with their fellows.

A Wilmington, N. C., paper states that the Southern Bell Telephone & Telegraph Company will advance its rates in that city on the 1st of July. Office 'phones after that date will cost \$30 a year, instead of \$20 as formerly, and residence 'phones will be increased from \$15 to \$18.

The American Long Distance Telephone Company has secured right of way through the principal counties and cities and will build a line from St. Louis to Evansville, Ill., making a complete circuit with Chicago and New York.

Col. C. E. McCluer, late superintendent of the Bell Telephone Company, Richmond, Va., has been appointed general manager of the Richmond Telephone Company. The appointment takes effect July 1.

New Companies Incorporated.

The Eureka & Mound City Telephone Company, Eureka, S. D. Capital stock, \$2,000. Incorporators: F. W. Boettcher, Walter C. Poehler, Eureka; Louis H. Clyborne; Chauncey E. Eckhart, Mound City; Alvin H. Poehler, Minneapolis, Minn.

The Ogle County Telephone Company, Rochelle, Ill., certified to an increase of capital stock from \$5,000 to \$10,000.

The Belvidere Telephone Company, Belvidere, Ill., has certified to an increase of capital stock from \$10,000 to \$25,000.

The Kendallville & Cresco Farmers' Telephone Company, Kendallville, Ia. Capital stock, \$360. Incorporators: C. C. Brown, Thomas Heines and M. H. Culbert.

The Lawrence Telephone Company, Ashland, Ky., has increased its capital stock from \$12,000 to \$24,000.

The South Missouri Telephone Company, Pierce City, Mo. Capital stock, \$20,000. Incorporators: R. J. Armstrong, G. E. Armstrong, Albert Newman and others.

The Illinois Telephone and Telegraph Company, Chicago. Capital stock, \$250,000. Incorporators: Ralph N. Bowman, Samuel N. McLaughlin and Thomas J. Holmes.

The Atchison Telephone Company, Atchison, Kan. Capital stock, \$20,000. Directors: E. H. Berry, O. D. Walker, George Storck, J. T. Hersey and S. A. Frazier.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indh., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Albany, N. Y.—June 27:					
Albany Ry. Co.	100	2,000,000	\$1,750,000 1 1/2 % Q., Feb. '98.	142	145
Troy City Railway Co.	100	2,000,000	1 % Q., Dec. 10, '97.	65	65 1/2
Traction Co. (Saratoga)	100	50,000	50,000		
Allentown, Pa.—June 27:					
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000		15
Bridgeport, Conn.—June 27:					
Bridgeport Traction Co.	100	2,000,000	2,000,000 1 % Aug., '97.	45	60
Baltimore, Md.—June 27:					
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000 5 % S., July 2, '97.	72	73
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000 2 1/2 % S., Jan. 15, '98.	23 1/2	23 1/2
Central Ry. Co. of Baltimore City	50	800,000	800,000 6 % A., Dec., 1897.	80	82 1/2
Boston, Mass.—June 27:					
New England Street Ry.	25	5,000,000	1,081,925 1 % Q., Jan. 15, '97.		
North Shore Traction Co.	100	4,000,000	4,000,000	10	15
North Shore Traction Co. pfd.	100	2,000,000	2,000,000 6 % S., A. & O.	72	76
West End Street Ry. Co.	50	10,000,000	9,085,000 4 % S., Oct., '97.	83 1/2	84
West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000 4 % S., Oct. 1, '97.	103 1/2	104
Boston Elevated R. R.	100	10,000,000		65 1/2	66 1/2
Brooklyn, N. Y.—June 27:					
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400 2 % Feb. 1, 1898.	200	
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	54 1/2	54 1/2
Brooklyn Heights Railroad		200,000	200,000		
Brooklyn City RR.	100	12,000,000	12,000,000 2 1/2 % Q., Jan., '98.	211 1/2	213
Brooklyn, Queens Co. & Sub. RR.		2,000,000	2,000,000		
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000 1 1/2 % Oct. 1, '97.	201	205
Kings County Elevated		4,750,000	4,750,000		2
Kings County Traction Co.	100	4,500,000	4,500,000 1 % July 26, '97	47	48
Nassau Electric Railroad		6,000,000	6,000,000		37
Atlantic Avenue Railroad	50	2,000,000	2,000,000		74
Brooklyn, B. & W. E. Railroad		1,000,000	1,000,000		80
Buffalo, N. Y.—June 27:					
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	58	60
Buffalo Railway Co.	100	6,000,000	5,370,500 1 % Q., Dec., '97.	79	81
Columbus, O.—June 27:					
Columbus Street Railroad	100	8,000,000	8,000,000 1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000		
Charleston, S. C.—June 27:					
Charleston City Ry. Co.	50	100,000	100,000 3 % S., Jan., '97.		
Enterprise City RR. Co.	25	1,000,000	250,000		
Chicago, Ill.—June 27:					
Chicago City Ry. Co.	100	12,000,000	12,000,000 8 % Q., Dec. 31, '97.	251	255
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800		
Lake Street Elevated RR.	100	10,000,000	10,000,000	12 1/2	18
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000		3
Met. West Side El. const. stk.	100	15,000,000	2,500,000		
North Chicago City RR.	100	10,000,000	6,600,000 8 % Q., Jan., '98.	208	212
South Chicago City RR.	100	500,000	249,900		
South Chicago City Railway	100	2,000,000	1,603,200		
West Chicago St. RR. Co.	100	20,000,000	18,189,000 1 1/2 % Q., Feb. '98.	92 1/2	93 1/2
Chicago West Div. Ry.		1,250,000	624,900 35 %		
Chicago Passenger Ry.	100	2,000,000	2,000,000 5 % S.		
Cincinnati, Ohio.—June 27:					
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000		20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000 2 1/2 % Q., Feb., '98.		75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000	23	25
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000 1 1/2 % Q., Jan., '98.	112 1/2	113
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000 1 1/2 % Q., Jan., '98.		
Cleveland, Ohio.—June 27:					
Akron, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000 3/4 % Jan., '98.	89	40
Cleveland City Ry.	100	8,000,000	7,600,000 3/4 % Q., Oct., '97.	55	60
Cleveland Electric Ry.	100	12,000,000	12,000,000 3/4 % Q., Oct., '97.	50	58
Detroit, Mich.—June 27:					
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	100 1/2	
Fl. Wayne & Belle Isle Ry.	100	400,000	400,000 5 % July, '96.	175	
Rapid Railway Co.		250,000	250,000		100
Detroit Electric Railway		1,000,000	1,000,000		
Wyandotte & Detroit River Ry.	100	250,000	200,000	100	110
Dayton, O.—June 27:					
City Railway Co.	100	1,500,000	1,470,600 1 1/2 % Q., Jan. 1, '98.	100	102
City Railway Co. pfd.	100	500,000	500,000 1 1/2 % Q., Jan. 1, '98.	140	145
People's Street Railway		1,100,000		100	

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h \$30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.

i \$250,100 of stock owned by North Chicago Street Railroad Company.

j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

k \$5 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; \$225,100 of stock owned by West Chicago Street Railroad Company.

l Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.	Rate and Date of Last Div.	Bid.	Asked.
Authoriz'd	Issued.				
Hartford Conn.—June 27:					
Hartford Street Ry. Co.	100	\$4,000,000	\$200,000 8 % S., Jan., '98.	140	
Hartford & West Hartford RR.	100	1,000,000	247,000		
Holyoke Mass.—June 27:					
Holyoke Street Ry. Co.	100	400,000	400,000 8 % A., Jan., '98.	200	205
Hoboken, N. J.—June 27:					
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000 8 %, 1892.	70	
Indianapolis, Ind.—June 27:					
Citizens' Passenger Ry.		5,000,000	5,000,000		28 1/2
Lancaster, Pa.—June 27:					
Pennsylvania Traction Co.	100	10,000,000	9,900,000		
Lancaster & Col. Electric Ry.			87,500		
West End Street Railway					
Louisville, Ky.—June 27:					
Louisville Ry.	100	4,000,000	3,500,000 1 1/2 % Q., Oct., '97.	31	39
Louisville Ry. 5 % pfd.	100	2,500,000	2,500,000 2 1/2 % S., Oct. 1, '97.	95	100
Minneapolis, Minn.—June 27:					
Twin City Rapid Transit	100	17,000,000	15,010,000 1 1/2 % Jan., '98.	14	20
Twin City Rapid Transit pfd.		8,000,000	1,714,200		100
Montreal, Canada.—June 27:					
Montreal Street Ry. Co.	50	4,000,000	4,000,000 8 % S., M. & N.	257	257 1/2
Toronto Street Ry. Co.	100	6,000,000	6,000,000 1 1/2 % S., J. & J.	98	98 1/2
Memphis, Tenn.—June 27:					
Memphis Street Railway Co.	100	500,000	500,000	15	
New Haven, Conn.—June 27:					
Fair Haven & Westville RR.	25	1,500,000	900,000 4 % S., Sept., '97.	60	
New Haven Street Railway Co.	100	1,250,000	1,000,000 2 1/2 % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000		
Winchester Avenue RR.	25	1,000,000	600,000	40	42
New Orleans, La.—June 27:					
Canal & Claiborne RR. Co.	40	240,000	240,000 4 % S., Jan., '98.	140	160
New Orleans & Carrollton RR.	100	1,200,000	1,200,000 1 1/2 % Q., Jan., '98.	123 1/2	128
New Orleans Traction Co.	100	5,000,000	5,000,000	1	3
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	7	10
Crescent City RR.	100	2,000,000	2,000,000 3 % S., Jan., '98.		30
New Or. City & Lake RR.	100	2,000,000	2,000,000 4 % S., Jan., '98.	81	88
Orleans Railroad	50	500,000	185,000 1 1/2 % Q., June, '94.	16	17
St. Charles Street Railway	50	1,000,000	1,000,000 1 1/2 % Q., Jan., '98.	58 1/2	54 1/2
New York—June 27:					
Central Crostown RR.	100	600,000	600,000 2 1/2 % Q., July, '97.	240	
Christopher & 10th Sts. RR. guar.	100	650,000	650,000 2 % Q., Jan., '98.	150	160
Dry Dock, E. Bldg. & Battery RR.	100	1,200,000	1,200,000 1 1/2 % Q., Feb., '98.	175	195
Metropolitan Street Ry. Co.	100	30,000,000	30,000,000 1 1/2 % Q., Jan., '98.	158 1/2	158 1/2
Bleecker St. & Fulton Ry. guar.	100	900,000	900,000 4 % A., July, '97.	32	38 1/2
Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000 2 1/2 % Q., Oct., '97.	10	120
Gen. Park N. & E. Rivers RR. guar.	100	1,800,000	1,800,000 2 1/2 % Q., Jan., '98.	180	185
Eleventh Avenue RR.	100	1,000,000	1,000,000	320	325
42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000 4 1/2 % Q., Feb., '98.	330	360
Ninth Avenue RR.	100	800,000	800,000	170	180
Sixth Avenue RR.	100	2,000,000	2,000,000	200	210
Twenty-third St. R. B. Co. guar.	100	600,000	600,000 4 % Q., Feb., '98.	325	
Second Avenue RR.	100	2,500,000	1,862,000 2 % Q., Jan., '98.	17 1/2	30
Third Avenue RR.	100	12,000,000	10,000,000 2 % Q., Feb., '98.	167	170
42d St., Manhattan & St. Nich. Av.	100	2,500,000	2,500,000	60	65
Union (Huckleberry) Ry.	100	2,000,000	2,000,000	175	200
Newark N. J.—June 27:					
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	49	49 1/2
Newark Passenger Ry.	100	6,000,000	6,000,000		
Rapid Transit Street Ry.	100	504,000	504,000 1 1/2 % A.	180	190
Pittsburg, Pa.—June 27:					
Allegheny Traction Co.	50	500,000	500,000		45
Consolidated Traction Co.	50	15,000,000	15,000,000 2 % Jan., '98.	11 1/2	14 1/2
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000 3 % May, '97.	47 1/2	49
Central Traction Co.	50	1,500,000	1,900,000		
Citizens' Traction Co.	50	8,000,000	18,000,000 6 % A.		
Duquesne Traction Co.	50	8,000,000	18,000,000 6 % A.		
Pittsburg Traction Co.	50	2,500,000	1,900,000 3 % Aug., '95.		
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000 2 1/2 % Jan., '98.		
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	12,994,889 2 % Aug., '95.		
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000 5 % Jan., '96.		19
Pittsburg & West End Ry.	50	1,500,000	1,500,000 5 % A., June 30, '97.		
Second Avenue Traction Co.	50	4,000,000	14,000,000		
Suburban Rapid Transit Co.	50	800,000	200,000		

* Unlisted. † Full paid. ‡ Outstanding. § Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.

PASSENGER RAILWAYS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—June 27:						
Union Street Railway Co.....	100	\$350,000	\$350,000	2%, Feb. '98.	158	
Northampton, Mass.—June 27:						
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175
Omaha, Neb.—June 27:						
Omaha Street Ry.....	100	5,000,000	5,000,000		25	
Paterson, N. J.—June 27:						
Paterson Ry. Co.....	100	1,250,000	1,250,000		35	86
Providence, R. I.—June 27:						
United Traction & Electric Co.....	100	8,000,000	8,000,000	3/4%, Jan. '98.	59 1/4	63
Philadelphia.—June 27:						
Fairmount Park Trans. Co., \$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14 1/2	
Hestonville, Man. & Fairmount.....	50	1,966,100	1,966,100	2 1/2%, July 15, '97.	43 1/2	
Hestonville, Man. & Fairmount, 6% pfd.	50	533,900	533,900	8% S.—Jan. 10, '98.	65 1/2	
a Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3% Feb. 1, '98.	65	
Union Traction Co., \$12 1/2 pd	50	80,000,000	29,930,450		1 1/2	17 1/2
c Electric Traction Co.....	50		8,297,920		71 1/2	
d Citizens' Passenger Ry.....	50	500,000		\$3 share Q.	275	
e Frankford & Southwark Pass. R.	50		1,875,000	\$14 share A.—Apr. 97	396	
f Lehigh Avenue Ry. Co.....	50	1,000,000			43	
g Lombard & South Street Ry.....	25		1,000,000	A. & O.	89	90 1/2
h Second & Third Streets Ry.....	50	1,060,000		\$9 share A., Mar. 97	256	
i People's Traction Co.....	50	10,000,000	16,000,000	3% A., April, '97.		
j Germantown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1898.	135	
k Green & Coates Passenger Ry.....	50	500,000	150,000	3% Jan. 1898.	138 1/2	
l People's Passenger Ry., com.	25	1,500,000	740,000			
m People's Passenger Ry., pfd.	25	750,000	277,402			
n Philadelphia Traction Co.....	50	30,000,000	20,000,000	4% S.—Oct. 1, '97.	84 1/2	85
o Catherine & Bainbridge St.	50		400,000	6% A.—Mar. '97.		
p Continental Pass. Ry., guar.	50	1,000,000	580,000	\$6 share July, '97.	142 1/2	
q Empire Passenger Ry. Co.....	50	600,000	600,000			
r Philadelphia City Pass. Ry.....	50	1,000,000	1,475,000	\$7.50 share July '97	175	180
s Philadelphia & Gray's Fy. RR.	50	1,000,000	298,650	\$8.50 share July '97	90 1/4	
t Ridge Avenue Passenger Ry.....	50	750,000	120,000	\$12 share July '97	291	300
u Philadelphia & Darby Ry. guar.	50		200,000	\$2 share July, '97.		
v 17th & 19th Sts. Pass. Ry. guar.	50		250,000	1 1/2% S., July, '97.	157 1/2	
w Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	885,000	\$1 sh. A., July, '97	280 1/4	
x Union Passenger Ry. Co.....	50	1,500,000	900,000	\$9.50 sh. A., July '97	234	
y West Philadelphia Pass. Ry.....	50	750,000	175,000	\$10 share, July '97	234	235
Rochester, N. Y.—June 27:						
Rochester Railway Co.....	100	5,000,000	5,000,000		9	12
Reading, Pa.—June 27:						
Reading Traction Co.....	50	1,000,000	1,000,000	Semi-an. Jan. & Jy	15	
a City Passenger Ry.....	50	850,000	850,000	Jan., '98.	112	
b East Reading Electric Ry.....	50	1,000,000	11,000,000	Jan., '98.	64	
St. Louis Mo.—June 27:						
Fourth Street & Arsenal Ry.....	50	800,000	150,000			
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec. 1898.		
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% Jan., '98.	122 1/2	125
National Railway Co.....	50	2,500,000	2,479,000	1 1/2% Jan., '98.		
Cass Avenue & Fair Grounds.....	100	2,500,000	2,500,000			
Citizens' RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% Jan., '98.	95	105
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% Jan., '98.	170	172 1/2
People's RR. Co.....	50	1,000,000	300,000	50c., Dec., '89.		
Southern Electric Ry..... com.	50	500,000	500,000		87	60
Southern Electric Ry..... 6% pfd.	100	1,000,000	1,000,000	1 1/2% Jan., '98.	108	110
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000		55	56
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '98.		175
San Francisco, Cal.—June.						
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.		110
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	40	50
Market Street Ry.....	100	18,750,000	18,750,000	\$2, 60c. per share.	52 1/2	53
Presidio & Ferries RR.....	100	1,000,000	550,000			8 1/2
Scranton, Pa.—June 27:						
Scranton Railway Co.....	50	6,000,000	2,500,000		10	12
m Scranton & Carbondale Trac. Co.	100	500,000	500,000			18
n Scranton & Pittston Traction Co.	100	1,050,000	1,050,000			
Springfield Ill.—June 27:						
Springfield Consolidated Ry.....	100	750,000	750,000			11
Springfield O.—June 27:						
Springfield Street Ry.....	100	1,000,000	1,000,000			2
Springfield, Mass.—June 27:						
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	205	210
Toronto Canada.—June 27:						
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	98	98 1/2
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	257	257 1/2
Washington, D. C.—June 27:						
Belt Ry. Co.....	50	500,000	500,000			
Capital Traction Co.....	100	12,000,000	12,000,000	65c. per sh. Oct. 97.	73 1/2	74
Columbia Ry. Co.....	50	400,000	400,000	6% A.	78	80
Eckington & Soldiers' Home Ry.....	50	707,000	652,000		8	
Georgetown & Tenallytown Ry.....	50	200,000	200,000			
Metropolitan RR. Co.....	50	1,000,000	458,900	2 1/2% Q.	123	124
Worcester, Mass.—June 27:						
Worcester Traction Co..... com.	100	8,000,000	8,000,000		15	17
Worcester Traction Co..... 6% pfd.	100	2,000,000	2,000,000	8% S., Feb., '98.	95	96
Worcester & Suburban Street Ry...	100	550,000	542,500	4 1/2% S., 1897.	84	
Wilkesbarre, Pa.—June 27:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. § Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidation. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
 f Lease to Electric Traction Company.
 g Controlled by Frankford & Southwark Passenger Railway.
 h Lease to People's Passenger Railway at \$5 per share.
 i Majority of stock owned by People's Traction Company.
 j Lease to Union Traction Company.
 k Lease transferred to Union Traction Company.
 l Lease to United Traction Co. at a rental of \$10,000 per an. in 1896-7-8, \$20,000 p. a. in 1899-1900 and \$30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
 m Dividend of 10% guaranteed by Reading Traction Company.
 n Dividend of 6% guaranteed by Reading Traction Company.
 o Leased and operated by the Scranton Railway Company, formerly, Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—June 27:						
American Bell Telephone Co.....	100	50,000,000	23,650,000	4 1/2% Q., Jan., '98.	274	275
Erle Telegraph & Telephone Co.....	100			1% Q., Jan., '98.	68	69
New England Telephone Co.....	100	10,894,600	10,804,600	\$1.50, Feb. '98.	181	182
New York.—June 27:						
American Telegraph & Cable Co....	100	14,000,000	14,000,000	1 1/2% Q.	92 1/2	94 1/2
*Central & South Am. Tele. Co.....	100	6,500,000	6,500,000	1 1/2% Q.	101	103
*Commercial Cable Co.....	100	10,000,000	10,000,000	1 1/2% Q.	174	175
*Franklin Tele. Co..... 2 1/2% guar.	100	1,000,000		1 1/2% S.	40	44
Erle Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 1/2% Q., Jan., '98.	68	69
*Gold & Stock Tel. Co. guar. 6%	100	5,000,000		1 1/2% Q.	109 1/2	111
*International Ocean Tel. Co. guar 6%	100	8,000,000		1 1/2% Q.	108	111
Mexican Telephone Co.....	100	2,000,000			57 1/2	60
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1 1/2% Q., Jan., '98.	147	149
*Pacific & Atlantic Tele. guar. 4%	25	2,000,000		2% S.	72	80
*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q.		
*Sout'n & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2% S.	85	
*Commercial Union Telegraph Co....	25	500,000	500,000	8% S., Jan. 1, '98.	110	113
Western Union Telegraph Co.....	100	97,870,000		1 1/2% Jan., '98.	98 1/2	99 1/2
† Div. guar. by Postal Tele. Co.						
Miscellaneous.—June 27:						
American Dist. Tele. (Phila.).....	25	400,000		1% Q., Feb. '98.	14	
Bell Teleph. Co. (of Canada).....	100	3,168,000	3,168,000	2% S.	170 1/2	173
Chesapeake & Potomac Tele. Co....	100				59	
Chicago Telephone Co.....	100				202	
Central Dist. Ptg. & Tel. Co. (Pgh.)...	100	750,000	750,000			
Empire & Bay States Telegraph Co....	100				70	76
Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q.	70	72
*Northwestern Telegraph Co. guar	50	2,500,000	2,500,000	2 1/2% Q.	110	115
Providence (R. I.) Teleph. Co.....	50				87 1/2	
Southern New Eng. Teleph. Co.....	100	8,000,000			120	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authoriz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—June 27:						
Fort Wayne Electric Co.....	100					
Ft. Wayne Elec. Co. T. Sec. Series A.	25					
General Electric Co..... com.	100	40,000,000	30,460,000	2% Q., Aug., 1898.	88	88 1/2
General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	91	
T. H. Elec. Co. T. Secur., Series D.	50				2 1/2	8
Westinghouse Elec. & Mfg. Co. com.	50		146,700		23 1/2	24 1/2
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,068	1 1/2% Q., Feb., '98.	58 1/2	59
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,196,126			
New York.—June 27:						
Edison Elec. Ill'g Co., New York...	100	10,000,000	7,988,000		125	130
*Edison Elec. Ill'g Co., Brooklyn...	100	4,000,000	3,750,000	1 1/2% Oct., '97.	109	111
Edison Ore Milling Co.....	100				10	18
Edison Electric Storage Co.....	100				22	25
General Electric Co..... com.	100	40,000,000	30,460,000	2% Q., Aug., 1898.	88	88 1/2
General Electric Co..... pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	91	
Interior Conduit & Insulation Co....	100	1,000,000	1,000,000		41	
United Elec. Lt. & Pow. Co..... pfd.	100					
Pittsburg, Pa.—June 27:						
Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	
East End Electric Light Co.....	50	800,000	800,000	Q.		10
Philadelphia, Pa.—June 27:						
Edison Electric Light Co.....	100	2,000,000			144 1/2	
*Electric Storage Battery Co. com.	100	8,500,000			28 1/2	
*Electric Storage Battery Co. pfd.	100	5,000,000			80	
*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000		50c. p. sh., Oct. '97.		
*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000		6% Oct., '97.		
Northern Elec. Light & Power Co....	10	6,500,000	550,000	\$2.50 dis. Jan. 11 '97	18 1/2	14
Southern Elec. Light & Power Co....	10	187,500	187,500		15	
Miscellaneous.—June 27:						
Brush Electric Co.....	50					
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000			82	87
Missouri-Edison (St. Louis)..... com.	100				14	17 1/2
Eddy Electric Mfg. Co.....	25				1 1/2	
Hartford (Conn.) Elec. Light Co....	100	850,000			122	130
Hartford (Conn.) Lt. & Power Co....	25	175,000			6	11
New Haven (Conn.) Elec. Lt. Co....	100	100,000			165	
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000		2% Q., Oct., '96.	82	90
Rhode Island Elec. Protec. Co.....	100				110	120
Royal Elec. Co. (Montreal).....	100	1,000,000		2% Q.	105	155
Toronto (Canada) Elec. Light Co....	100	1,085,000	1,085,000	1 1/2% Q.	185 1/2	186 1/2
Thomson-Houston Welding Co.....	100			3% S., Dec. 1, '96.	100	100
Woonsocket (R. I.) Electric Co.....	100				100	110

ALLIED INDUSTRIES.

Boston Mass.—June 27:							
American Electric Heating Co.....	50	10,000,000	.....	...	..	..
Street Ry. & Ill'u'g Properties...pfd	100	4,500,000	1,248,700	\$8 per sh. Feb. 1, '98	..	..
United Electric Securities Co...pfd.	100	.....	.....	3¼ % Feb., '98.	80	85
New York.—June 27:							
Consolidated Electric Storage Co...	...	.....	.....	.....	18	20
Edison European.....	.....	.....	.....	.....	..	8
Safety Car Heating & Lighting Co...	100	.....	.....	.....	96	100
Worthington Pump Co.....com.	100	5,500,000	5,500,000	.....	80	88
Worthington Pump Co.....pfd	100	2,000,000	2,000,000	7 %	90	92	
Philadelphia, Pa.—June 27:							
Acetylene L. H. & P. Co.....\$35 pd.	50	1,000,000	.....	.....	..	..
Electro Pneumatic Trans. Co.....	10	1,500,000	.....	.....	..	..
United Gas Improvement Co...scrip.	50	10,000,000	.....	.....	74½	..
Weisbach Commercial Co.....com.	100	8,500,000	.....	.....	27½	28
Weisbach Commercial Co.....pfd.	100	500,000	.....	2 % Q	58	..
Weisbach Light Co.....	5	525,100	.....	.....	61	..
Weisbach Light Co., Canada.....	5	500,000	.....	.....	..	1
Pittsburg, Pa.—June 27:							
Carborundum Mfg. Co.....	100	200,000	200,000	.....	..	..
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	110	112	
Miscellaneous.—June 27:							
*Barney & Smith Car Co.....com.	100	.....	1,000,000	.....	10	15
*Barney & Smith Car Co.....pfd.	100	.....	2,500,000	2 %	60	67
Billings & Spencer Co.....	35	.....	.....	.....	40	85
Consol. Car Heating Co.....	100	1,250,000	1,350,000	1½ % Feb. '98.	20	85	
Johns-Fratt Co.....	100	.....	.....	.....	102	8
*Fratt & Whitney Co.....com.	100	.....	.....	.....	4	8
*Fratt & Whitney Co.....pfd	100	.....	.....	.....	45	80
Hilliwell-Bierce Co.....com.	.....	.....	.....	.....	70	80
Hilliwell-Bierce Co.....pfd.	.....	.....	.....	2 % Sept. 1, '97.	107	108
Shultz Belting Co.....	100	500,000	.....	.....	107	108
St. Charles Car Co.....	..	.....	.....	.....	85	90
* Unlisted							

BONDS.

PASSENGER RAILWAY.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Albany, N. Y.						
Date of Quotation—June 27, 1898						
The Albany Ry. Co. 1st mtg. 5s.	.....	\$29,000	1906	J. & J.	111	.....
The Albany Ry. Co. Cons. mtg. 5s.	\$500,000	427,500	1907	M. & N.	111	.....
The Albany Ry. Co. Gen. mtg. 5s.	750,000	875,000	1907	M. & N.	111	.....
Watervliet Turnpike & RR. 1st mtg. 5s.	850,000	850,000	1919	M. & N.	117	.....
Watervliet Turnpike & RR. 2d mtg. 5s.	150,000	150,000	1919	M. & N.	115½	.....
Troy City Railway Co. 1st mtg. 5s.	.....	.....	.....	.....	105	105½
Interest guar. by Albany Ry. Co. Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—June 27, 1898						
Baltimore City Pass. Ry. 1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co. 1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	.....
Baltimore Trac. Co. Exten. & Imp. g. 5s.	1,250,000	1,250,000	1901	M. & S.	102½	103
Bal. Trac. Co. No. Balto div. 1st mtg. g. 5s.	1,750,000	1,750,000	1942	J. & D.	114½	115
Bal. Trac. Co. Coll. Trust. 1st mtg. g. 5s.	750,000	.....	1900	J. & J.	101½	.....
Baltimore Traction Co. Convertible 5s.	800,000	.....	1906	N. & M.	103½	.....
Central Pass. Ry. Co. 1st mtg. 5s.	96,000	117,000	1912	J. & J.	110	.....
Central Pass. Ry. Co. Cons. mtg. g. 5s.	801,000	580,000	1932	M. & N.	113	116
City & Suburban Ry. 1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	113½	114½
Lake Roland Elev. 1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	.....
Metropolitan Ry. (Wash.) 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	117	119
The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. \$151,000 in escrow to retire 1st mtg. bds.						
Boston, Mass.						
Date of Quotation—June 27, 1898						
Lynn & Boston RR. 1st mtg. g. 5s.	5,879,000	8,702,000	1924	J. & D.	161½	105
West End Street Ry. Deben. g. 5s.	8,000,000	8,000,000	1902	M. & N.	104	.....
West End Street Ry. Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....
\$1,874,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—June 27, 1898						
Enterprise Street RR. 1st mtg. 5s.	500,000	47,000	1906	J. & J.	.....	.....
Charleston City Ry. 1st mtg. 5s.	850,000	.....	.....	J. & J.	.....	.....
Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—June 27, 1898						
Chicago City Ry. 1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101½	102½
Chicago Passenger Ry. 1st mtg. 5s.	400,000	400,000	1906	F. & A.	103½	.....
Chicago Passenger Ry. Cons. mtg. 5s.	1,000,000	600,000	1929	J. & D.	.....	.....
Chicago & So. Side R. T. 1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	.....
Chicago & So. Side R. T. 2d mtg. g. 5s.	1,500,000	750,000	1907	J. & J.	.....	.....
Chicago West Div. Ry. 1st mtg. 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	.....
Lake Street Elevated RR. 1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	69	70
Metrop. W. Side Elev. Ry. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	45	48
North Chicago St. RR. 1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	104	105
North Chicago St. RR. Cert. Indeb. 6s.	500,000	500,000	1911	J. & J.	.....	103
North Chicago City Ry. 1st mtg. 5s.	500,000	500,000	1900	J. & J.	103	.....
North Chicago City Ry. Consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	.....
West Chicago St. RR. 1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	103	104
West Chicago St. RR. 2d mtg. 5s.	2,700,000	700,000	1911	J. & D.	100	100½
West Chicago St. RR. Cons. mtg. g. 5s.	12,500,000	6,000,000	1936	.....	90½	91½
W. Chicago St. RR. Tunnel. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	112	.....
Redeemable at option on 60 da. notice. Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. Subject to call after Oct. 1, 1899, at \$110 and interest. Assumed by W. Chi. RR. Co., lessee. Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—June 27, 1898						
Otn. New & Cov. St. Ry. 1st Con. mtg. g. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101
Mt. Adams & Eden Pk In. 1st mtg. 5s.	46,000	46,000	1900	A. & O.	107½	.....
Mt. Adams & Eden Pk In. 2d mtg. 5s.	100,000	100,000	1905	A. & O.	111	.....
Mt. Adams & Eden Pk Inc. Cons. mtg. 5s.	531,000	531,000	1906	M. & S.	108½	.....
So. Cov. & Otn. St. Ry. 1st mtg. 5s.	250,000	250,000	1912	M. & S.	119	.....
So. Cov. & Otn. St. Ry. 2d mtg. 5s.	400,000	400,000	1932	J. & J.	129½	.....
Assumed by the Cin. St. Ry. Co. \$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—June 27, 1898						
aBrooklyn Street RR. Co. 1st mtg. 5s.	600,000	600,000	1908	M. & S.	106	107
Cin. New't & Cov. St. Ry. Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	99	101
Cleveland City Cable Ry. 1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	100	102
Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1918	M. & S.	100	103
Columbus (O.) Cent. Ry. 1st mtg. g. 5s.	1,000,000	1,500,000	1918	M. & N.	101½	.....
aEast Cleveland RR. 1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	105	.....
Fl. Wayne (Ind.) Elec. Ry. 1st mtg. g. 5s.	200,000	200,000	1922	M. & N.	.....	.....
Lorain (O.) Street Ry. 1st mtg. 5s.	200,000	200,000	1915	J. & J.	.....	.....
St. Ry. Co., Grand Rapids. 1st mtg. 5s.	600,000	600,000	1912	J. & D.	.....	.....
\$1,900,000 in escrow to retire bonds of absorbed companies, marked a. Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—June 27, 1898						
Detroit Citizens' St. Ry. 1st cons. 5s.	7,000,000	8,835,000	1905	A. & O.	96½	99
Fl. Wayne & Belle Isle Ry. 1st mtg. 5s.	400,000	877,000	1902	A. & O.	.....	.....
The Detroit Ry. 1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
\$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—June 27, 1898						
New Haven St. Ry. 1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	.....
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	.....
Winchester Avenue RR. 1st mtg. g. 5s.	600,000	600,000	1912	M. & N.	106	.....
Winchester Avenue RR. Deben. g. 5s.	100,000	94,000	1909	M. & S.	103	.....

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
New Orleans La.						
Date of Quotation—June 27, 1898.						
Canal & Claiborne RR.....1st mtg. 6s.	\$150,000	\$150,000	1912	M. & N.	102	....
Crescent City RR.....1st mtg. 6s.	.....	50,000	1899	M. & N.	101	....
Crescent City RR.....Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75½	77
New Orleans City RR.....1st mtg. 6s.	416,500	399,000	1903	J. & D.	108	111
N. Ori's City & Lake RR.....1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98½	99½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	110	....
Orleans Railroad Co.....Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	98½	100
St. Charles St. RR. Co.....1st mtg. 6s.	800,000	75,000	1906	J. & D.	104	....
\$123,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. \$890,000 outstanding.						
New York.						
Date of Quotation—June 27, 1898.						
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn).....1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	....
Atlantic Av. (Brooklyn).....Cons. mtg. 5s.	8,000,000	1,965,000	1931	A. & O.	106	109
Bro'dway & 7th Ave.....1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.....1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave.....2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface.....1st mtg. 5s.	1,125,000	1,125,000	1924	.....	114	116
Broadway Surface.....2d mtg. 5s.	1,000,000	1,000,000	1905	.....	105	106½
Brooklyn City RR. Co.....1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown.....1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114½	115½
Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
Brooklyn Heights RR.....1st mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n.....1st mtg. 5s.	8,500,000	8,500,000	1941	J. & J.	107	109
Brooklyn, Q's Co. & Sub'n.....1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	80	90
Brooklyn Rapid Transit.....gold 5s.	7,000,000	5,181,000	1945	.....	95½	.....
Bleecker St. & Fulton Ferry RR. 1st mtg. 7s.	700,000	700,000	1900	.....	101	104
Cent Pk, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crostown RR.....1st mtg. 6s.	250,000	250,000	1922	M. & N.	118½	122
Coney Island & Brooklyn RR. 1st mtg. 5s.	800,000	800,000	1903	J. & J.	103	105
Dry Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s.	1,000,000	980,000	1932	J. & D.	111½	116½
Dry Dock, E. Bd'y & Bat'y R. scrip 5½s.	1,000,000	1,000,000	1914	F. & A.	100	103
Eighth Av. RR. Co.....Cert. Indeb. 6½s.	1,000,000	1,000,000	1914	F. & A.	104	....
12d St., Man. & St. Nich. Av. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
12d St., Man. & St. N. Av. 2d mtg. 1nc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1938	M. & S.	117½	120
Metropolitan St. Ry. Co. g. m. cl. tr. g. 5s.	12,500,000	1,500,000	1907	F. & A.	113½	115
Second Avenue Ry. Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry. Gen. cons. mtg. 5s.	800,000	800,000	1909	J. & J.	106	108
Steinway Ry. (L. I.).....1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co.....1st mtg. 5s.	850,000	850,000	1919	.....	107	....
Third Avenue RR.....1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	124½
Twenty-third Street Ry.....1st mtg. 6s.	.....	.....	1909	J. & J.	.....	.....
Twenty-third Street Ry.....Deb. 5s.	150,000	150,000	1906	J. & J.	108	109
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	112	114
Westchester Electric RR.....1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	....
\$1,085,000 in escrow to retire gen. mtg. bonds. \$14,850,000 in escrow to retire maturing obligations. \$552,000 in escrow to retire 1st and 2d mtg. bonds. In treasury, \$80,000. Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—June 27, 1898.						
Montreal St. Ry.....1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
Toronto St. Ry.....1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
\$135,000 per m. single track authorized. \$600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—June 27, 1898.						
Continental Pass. Ry.....1st mtg. 6s.	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....1st mtg. 7s.	800,000	200,000	1900	J. & J.	....	....
Green & Castles St. Ry.....1st mtg. 6s.	100,000	100,000	1901	J. & J.	....	....
Hambard & So. St. Pass. Ry.....1st mtg. 6s.	150,000	.....	.....	.....	....	....
People's Pass. Ry.....1st mtg. 7s.	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....2d mtg. 5s.	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.....Cons. mtg. 5s.	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.....Sbk. tra. cert. g. 4s.	6,694,210	.....	1943	.....	102	108
Phila. City Passenger Ry.....1st mtg. 5s.	200,000	200,000	1910	J. & J.	....	....
Philadelphia Trac. Co.....Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105
Fifteenth & 15th St. Ry.....1st mtg. 7s.	100,000	100,000	1903	A. & O.	....	....
Union Passenger Ry.....1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
Union Traction Co.....Col. tr. 4s.	29,735,000	29,724,876	1905	A. & O.	....	....
West End Passenger Ry.....1st mtg. 7s.	.....	.....	1945	.....	....	....
West Phila. Pass. Ry.....1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115½	....
West Phila. Pass. Ry.....2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116½
The trust certificates were issued to the public for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—June 27, 1898.						
Pittsburg, Knox & Allentown.....6s.	500,000	500,060	1931	M. & S.	....	....
Int'l Traction Co.....1st mtg. 5s.	875,000	875,000	1930	J. & J.	....	....
Int'l Traction Co.....2d mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	....	....
Int'l Traction Co.....1st mtg. 6s.	1,500,000	1,500,000	1930	J. & J.	109½	110
Int'l Traction Co.....2d mtg. 6s.	50,000	50,000	1913	J. & J.	....	....
Int'l Traction Co.....3d mtg. 6s.	1,250,000	1,250,000	1942	J. & J.	....	....
Int'l Traction Co.....4th mtg. 6s.	750,000	750,000	1928	M. & N.	105	....
Int'l Traction Co.....5th mtg. 6s.	250,000	250,000	1924	J. & J.	106	....
Int'l Traction Co.....6th mtg. 6s.	750,000	750,000	1927	A. & O.	....	....
Int'l Traction Co.....7th mtg. 6s.	1,500,000	1,500,000	1929	M. & N.	....	138½
Int'l Traction Co.....8th mtg. 6s.	500,000	500,000	1922	J. & J.	....	....
Int'l Traction Co.....9th mtg. 6s.	1,800,000	1,400,000	1930	A. & O.	111½	112½
Int'l Traction Co.....10th mtg. 6s.	2,500,000	2,000,000	1934	J. & D.	....	....
Int'l Traction Co.....11th mtg. 6s.	500,000	500,000	1918	M. & S.	....	....
Providence R. I.						
Date of Quotation—June 27, 1898.						
Providence Street Ry.....Coupon 5s.	50,000	50,000	1910	J. & D.	....	....
Providence Trac. & Elec. Co.....1st mtg. g. 5s.	9,000,000	8,247,000	1933	M. & S.	105	107
St. Louis.						
Date of Quotation—June 27, 1898.						
St. Louis & St. Louis RR.....1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	101
St. Louis & St. Louis RR.....2d mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
St. Louis & St. Louis RR.....3d mtg. 5s.	3,000,000	1,500,000	1907	J. & J.	107	108
St. Louis & St. Louis RR.....4th mtg. 5s.	1,800,000	1,000,000	1918	J. & J.	111	118

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—June 27, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	97	100
Jefferson Avenue Ry.....1st mtg. 5s.	400,000	400,000	1906	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 5s.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	106	107
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric 1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
†Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
od.						
San Francisco Cal.						
Date of Quotation—June, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR. 1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	127	129½
†Metropolitan Ry. Co.....1st mtg. 6s.	200,000	.....	.....	.....	.....	.....
†Omnibus Cable Co. 1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR.....1st mtg. 6s.	350,000	350,000	1912	J. & J.	105½	.....
†Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
†Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—June 27, 1898.						
Belt Ry. Co.....C.....mtg 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home Ry.....mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—June 27, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
†Citizens' St. R. (Ind. pols.) 1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
†Croftown St. Ry. (Buffalo) 1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
†Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.) 1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	104	104½
†Cross'n St. Ry. (Colo's, O.) 1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Con. Tram'g Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
†Minneapolis St. Ry. 1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	89	93
†No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
†No. Hudson Co. Ry. (N. J.) 2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
†No. Hudson Co. Ry. (N. J.) Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
†Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
†Rochester (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95½	.....
†St. Paul City Ry.....Cons. g. 5s.	5,500,000	4,298,000	1937	.....	89	92
†St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$750,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$87,000 in treasury.						
†\$390,000 res'vd to redeem prior liens.						
†\$620,000 in escrow.						
*With int'rea						

*With interest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—June 27, 1898.						
Edison Elec. Illuminating Co., Boston....	2,025,000	.....	Quar.	156	.....	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	108	.....
Pittsburg, Pa.						
Date of Quotation—June 27, 1898.						
Allegheny County Light Co. 1st mtg. 6s.	500,000	.....	1911	J. & J.	105	.....
Allegheny City Electric Light Co. 1st mtg. 4s.	260,000	.....	1913	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(June 27, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,312,000	4,312,000	1910	.....	110	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,156,000	1993	.....	117½	.....
Edison Elec. Ilig. Co. (Brooklyn).....	2,500,000	1,500,000	1940	.....	113½	.....
Edison Electric Light (Philadelphia)...	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis).....	4,000,000	.....	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q. Ry.	.....	.....
United Elec. Light & Power Co. (N. Y.)...	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—June 27, 1898.						
American Bell Telephone.....7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telegraph Co. ....7s.	.....	.....	.....	.....	108	.....
N. Y. & N. J. Telep. & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. ....5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—June 27, 1898.						
American Electric Heating.....5s.	500,000	500,000	.....	.....	.15	.19
Armington & Sims Eng. Co. ....10s.	.....	.....	.....	.....	25	.....
Barney & Smith Car Co. ....10s.	.....	.....	1943	J. & J.	95	100
Osbornum Mfg. Co. ....5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. ....5s.	75,000	.....	.....	.....	.....	.....
*Unlisted						
†Memorial.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 11½@12c.; casting, 11½@11½c.

The Consolidated Car Heating Company, Albany, N. Y., has declared the regular semi-annual dividend of 1½ per cent., payable August 15.

Work is being pushed on the Rockaway Beach branch of the Brooklyn elevated road and the line is expected to be in operation by July 15.

At a meeting of the directors of the Consolidated Railway Company in Baltimore on the 23d inst. a semi-annual dividend of 2 per cent., payable July 15, was declared.

The Philadelphia & West Chester Traction Company will meet on August 23 to vote on a proposition increasing its indebtedness from \$60,000 to \$400,000 by the creation of a mortgage.

The directors of the Metropolitan Street Railway, New York, have declared a dividend of 1½ per cent. on the stock of that company, payable July 15. Books closed June 27.

The directors of the Westinghouse Electric & Manufacturing Company have declared a quarterly dividend of 1½ per cent. upon the preferred stock of the company, payable July 1 to stockholders of record. Transfer books will reopen July 2.

The Edison Electric Illuminating Company of Brooklyn, N. Y., reports for May: Gross earnings, \$87,901, increase over same month in 1897, \$1,817; net, \$29,467, increase \$1,673; five months, gross, \$373,270, increase \$18,907; net, \$172,551, increase \$6,207.

The "Financial Chronicle" says: "The report that the Chicago City Railway Company will issue \$2,000,000 of new stock to defray the cost of the \$950,000 General Electric Railway and other expenditures, is officially denied, but there is a disposition to look upon the denials as more or less 'technical.'"

The injunction proceedings brought in the United States Circuit Court at Chicago by Charles A. Bates, to prevent the General Electric Railway Company and Lucius Clark and others from disposing of 20,000 shares of stock in the company which Bates claimed were his property have been dismissed by Judge Grosscup.

The Boston "Journal" states that "a majority of the General Electric Company's preferred stockholders are reported to have assented to the committee's plan for the remedying of the capital impairment." It does not state what the committee's plan is. The "Globe" states that exclusive of 100 stockholders the stock is divided into very small lots.

The "Daily Philadelphia Stockholder" has evidently felt some of the quickening effects of the war. It has lately appeared in an entirely new dress and made improvements in its various departments that place it on a par with the best daily financial newspapers published in this country. We congratulate our contemporary on these tokens of appreciation and prosperity.

The directors of the Metropolitan Street Railway Company, New York, have decided upon an increase of the capital stock of the company to \$40,000,000 by an additional issue of \$10,000,000. Of the proceeds of the new stock \$6,000,000 will be used in the retirement of outstanding debentures and the balance will be expended in the change of motive power on the Sixth and Eighth avenue lines by the substitution of the underground electric trolley for horse power.

"By clever detective work," says the Philadelphia "Times," "what is said to be an organized band among conductors to defraud the Consolidated Traction Company of Pittsburgh has been unearthed. A large number are supposed to be implicated in the conspiracy and numerous arrests are expected. Conductors William J. Flower and William M. Lasdusky have already been arrested, and the latter made a confession implicating a number of his associates. The scheme to defraud, it is said, was worked at transfer stations in this way: A car coming to the station with twenty passengers would have probably five transfers. The conductor would slip his confederate ten transfer slips, which would be turned into the company as cash. The proceeds of the day's stealings were divided later. The company officials claim that thousands of dollars have been taken from them in this way, and they believe similar schemes are being worked in other cities."

A special to the New York "Commercial," dated Philadelphia, June 24, states as follows: "Charles H. Schermerhorn, when asked to-day about his purpose in incorporating the Overland Telegraph Company, said that it was the intention of the incorporators to introduce a new system of telegraphy which would revolutionize the business. He also stated that he was not prepared yet to disclose to the public the secrets of the new system. Mr. Schermerhorn, who seems to be the leading spirit of the new company, is secretary of the Niagara Mining & Smelting Company. Gilbert Palen, another incorporator, is a physician who is interested financially in some of Mr. Schermerhorn's enterprises. Samuel B. Schrach is a dealer in undertakers' supplies, and J. A. Longstreet is a salesman."

An order approving a new or modified contract made between Bridge Commissioner John L. Shea and Frederick Uhlmann, receiver of the Brooklyn Elevated Railroad Company, and which turns over the tracks of the bridge railroad to the use of the elevated company, to be operated under the supervision of the Bridge Commissioner, was signed by Justice Maddox in the Supreme Court in Brooklyn on Monday last. All the parties to the action consented to this course. But one fare is to be charged for passage over the bridge and to any point in Brooklyn. If there should be a loss in the operation of the local railroad it shall be assumed by the "L" companies. The "L" roads must furnish their own motive power, as well as that of the local railroad, and defray all expenses, including repairs. If there is a profit, the city is to receive 5 per cent. of all profits amounting to \$10,000 or upward in a graded scale, reaching 25 per cent. on \$150,000 or over. For the additional use of the railroad track an annual rental of \$20,306.28 is to be paid. Ten cents per car is to be paid by the company for each round trip. This revenue shall not fall below \$250 a day.

In the Supreme Court on the 22d inst. Justice Bischoff vacated the temporary injunction obtained by James J. Phelan, a shareholder in the Municipal Electric Light Company of Brooklyn, N. Y., restraining the Edison Electric Illuminating Company of Brooklyn from carrying out the agreement made with the majority of the stockholders of the Municipal Company to purchase the shares of these stockholders. After the decision was handed down the Municipal Electric Light Company issued a circular giving the terms of the sale of its stock to the Edison Electric Illuminating Company. The Edison Company is to give the Municipal Company stockholders either cash or new consolidated mortgage bonds, 200 per cent. of the par value of their stock. In addition, the Edison Company is to deposit \$250,000 of the new bonds to be used in defraying all the debts and obligations of the Municipal Company. When such debts are paid, whatever amount is left over is to be divided among the stockholders of the Municipal Company. The circular estimates that this amount will be about 10 per cent. on the stock. The Municipal stockholders are also to receive the July dividend of 2½ per cent. on their stock. The new consolidated mortgage bonds of the Edison Company will be secured by a first lien on the stock of the Municipal Company to be purchased, and by a general mortgage on the property of the Edison Company, subject to the present first mortgage, which can be paid up in 1900 at 110. When that is done the consolidated mortgage will be a first lien upon all the company's property. The Municipal Company stockholders are requested to deposit their stock with the Manufacturers' Trust Company. In case the deal is not completed by August 1 stockholders will be entitled to the return of their stock, together with a pro rata share of the \$15,000 deposited by the Edison Company, after deducting the expenses incurred by the stockholders' committee.

ELECTRICITY.

Vol. XIV.

NEW YORK, JULY 6, 1898.

No. 26.

ELECTRICITY

Published every Wednesday by the
ELECTRICITY NEWSPAPER COMPANY.

Publication Office, - - 136 Liberty St., New York.
Long Distance Telephone, 4081 Cortlandt.

SUBSCRIPTION RATES:	
UNITED STATES,	\$2.50
IN CLUBS OF FIVE OR MORE,	2.00
FOREIGN COUNTRIES,	4.50
SINGLE COPIES,	10 cents

ADVERTISING RATES:

As **ELECTRICITY** reaches all classes interested in electrical work, its value as an advertising medium can be readily understood. Rates will be sent on application. Changes of advertisements should reach the office not later than the Saturday preceding the day of publication.

Entered at the New York Post Office as second-class mail matter.

THE TRADE SUPPLIED BY
THE AMERICAN NEWS COMPANY.

CONTENTS.

Alphabetical List of Advertisements,	iv
Classified List of Advertisements,	viii
Editorial Notes,	401-402
The United States Export Trade.	
The Como International Exhibition of Electricity.	
Roentgen Rays in Warfare.	
Under the Searchlight,	403
General Distribution from Central Stations by Direct Currents. By L. A. Ferguson. (Concluded),	403
Electrical Opportunities in Peru,	405
General Distribution from Central Stations by Alternating Currents. By Herbert A. Wagner. (Concluded),	405
Alternating Currents and Direct Currents in Lighting, etc. (Discussion),	407
Fifteenth General Meeting of the American Institute of Electrical Engineers,	409
Meeting of the Canadian Electrical Association,	409
E. M. F. of the Arc with Aluminum Electrodes,	410
Legal Notes,	410
The Volunteer Engineers,	410
The News,	410
Lighting Plants—Street Railways—Mines—Manufacturing—Company Matters—Personal and Miscellaneous—Electricians in the War.	
Commercial Paragraphs,	411
Recent Company Elections,	411
Incorporations,	411
A Special Prize Offer,	413
Telephone and Telegraph,	413
Electrical Securities—Stocks, Bonds, Etc.,	413
Notes for Investors,	418

EDITORIAL NOTES.

The United States Export Trade.

The export trade of the United States is undergoing a transformation which promises to influence the whole economic future of the country. As is well known, this country has reached the foremost rank among the industrial nations. For a number of years its position as the greatest producer of manufactures has been undisputed, but absorbed with its own internal development, and satisfied for the time being with the enormous home market of some 70,000,000 of people, it has until recently devoted but little concerted effort to the sale of its manufactures and machinery outside of its borders. Recently, however, the fact has become more and more apparent that the output of the United States manufacturers, developed by the remarkable inventive genius and industrial skill of our people with a rapidity which has excited attention throughout the great centers of manufacturing activity in Europe, has reached a point of large excess above the demands of home consumption. Under these circumstances it is not surprising that our manufacturers are looking to other countries for their markets, and especially is this the case among manufacturers of machinery and electrical apparatus. The conditions of export trade are therefore now being studied by every manufacturer who is confronted by the problem of finding new outlets for his products. Many lines of manufacture, and especially American electrical apparatus, have already been introduced into European countries of long-established pre-eminence, and are finding ready sale in competition with their own home products. This apparent phenomenon is readily explained, the reasons being the comparative cheapness of United States manufactures notwithstanding the higher rates for labor, and owing to the superior producing capacity of the American workman with the aid of improved labor-saving machinery. As the above results have been achieved with comparatively little effort, it is only fair to assume that with intelligent and systematized action on the part of the manufacturers and exporters in this country, aided as far as practicable by our diplomatic and consular representatives abroad, the United States has unfolded to it in regions as yet unopened to the full activity of commerce, possibilities of commercial expansion limited only by the use made of them. It is gratifying to observe that the business community of the United States seems already to have learned the significance of our industrial opportunity. The fact is demonstrated by the great increase in the volume of correspondence with the State Department in Washington of business houses, organizations and individuals

throughout the country, making inquiry as to possible markets for a variety of products. The State Department is devoting all its energies to the effort to satisfy the growing demand for information. For the next fiscal year, so we are informed, Congress has made provision for enabling the State Department to supplement the mail reports of consuls with cablegrams, notifying it immediately of any important commercial or industrial events.

In the South American countries especially, during the last few years, a demand has arisen for electrical machinery, and this has mostly been supplied by goods of American manufacture. But not only in South America are these openings to be sought. The far East, and particularly China, presents equal opportunities, which however are being fought hard for by European countries. China has a population of 400,000,000, and its foreign commerce amounts at present to about \$200,000,000 annually. Of this in 1896 Great Britain obtained about two-thirds, Japan one-eleventh and the United States one-twelfth. Our manufactured goods are already very popular in China, and it should soon become a vast field for enterprise. A New York Chamber of Commerce report already calls attention to an increase in our export trade to China of from \$9,117,059 in 1893 to \$17,978,065 in 1897, there being however but \$5,833 worth of electrical apparatus exported to that country from the United States during the last fiscal year. From the above figures it will readily be seen that although China purchases yearly a fair amount of American productions, electrical apparatus is as yet in little demand. With the new and more modern methods which are gradually being introduced into that thickly populated country, the demand for electrical machinery will assuredly go on steadily increasing until ultimately an extensive and profitable market will be created.

* * *

The Como International Exhibition of Electricity.

At Como, the birthplace of Alexander Volta, it is proposed to hold an International Exhibition of Electricity from May 15 to October 15, 1899, on the occasion of the centenary of the electric pile. It was thought that this would prove a most appropriate way of honoring the memory of the departed scientist and would at the same time afford an excellent opportunity of reviewing the history of a century in the vast field of electricity. A congress of electricians ready to present the most recent advances of the science and its applications will be its principal feature.

The exhibits will be divided into thirteen classes, which include a class of honor, consisting of Volta's discovery illustrated by his apparatus, bibliography, manuscripts, autographs, portraits, medals and per-

sonal objects. The other exhibits will comprise documents, publications and manuscripts, models and apparatus for didactic use, batteries and accumulators, steam boilers and engines, dynamos of every description, electric conductors, including aerial, subterranean and submarine, incandescent and arc lamps, the application of electricity to motive power, electricity in telegraphy and telephony, electro-metallurgy, including electric applications in mining and military operations, electricity in therapeutics, and various other applications of the electric current. No efforts are being spared by those having charge of the proposed Exhibition to make it a success, and undoubtedly the invitation to exhibit will be met with a hearty response by the manufacturers of electrical apparatus in many countries. The occasion would certainly seem important enough to warrant the hearty support of electricians from all over the world, marking as it does the anniversary of an invention which was the first step in the practical application of the electric current. All announcements of intention to exhibit should reach the committee having the matter in charge not later than October 31.

* * *

Roentgen Rays A short time ago in England in **Warfare.** a lecture was delivered before the Royal United Service Institution by Surgeon-Major Beavor, entitled "Working of the Roentgen Ray in Warfare," which in view of our extensive military operations in Cuba is particularly interesting and timely. The lecture was based on the result of experiences gained with the X-ray apparatus during a recent frontier expedition in India. The lecturer stated at the outset that his object was to give the results of the employment of the Roentgen rays in military surgery and to mention certain modifications in the construction of the appliances for generating the X-ray which had suggested themselves to him after working among the wounded on the field of battle and its adjacent hospitals. During the course of the lecture many cases of interest from the campaign were shown by means of magic-lantern slides thrown upon a screen. These consisted of bullet wounds sustained by officers and men, injuring bones, joints and internal organs, which baffled the skill of surgeons to ascertain their exact extent and which but for the application of the X-rays, so it was claimed, must have resulted in amputation and probable loss of life. The pictures shown included all manner of wounds. The most remarkable results obtained by the use of Roentgen rays were probably in the cases of a bullet imbedded in the backbone of one man, in the hip of another and in the heel of a third. In each of the cases referred to the bullets were successfully removed by aid of the rays, the men subsequently rejoining their respective regiments at the front. Great stress was laid by the speaker on the desirability of having all the apparatus for military work as simple in construction as possible, thus readily enabling the defects of wear and tear to be renovated.

As regards the most desirable means of transporting the apparatus, it was pointed out that it was not only possible but easy to have an X-ray outfit working at the front; that the cases exhibited were indisputable proof that even in savage warfare the X-ray could be brought thoroughly under control and in many cases alleviate an immense amount of human suffering. A most important point referred to by the lecturer was, that after trying every kind of transport in India—mules, camels, wheeled vehicles, etc.—he came to the conclusion that by far the safest and most satisfactory was human transport. As the portable apparatus did not exceed 80 to 100 pounds in weight, it was found that two men were all that were required, with a reserve of two more with reserve equipments. A bamboo pole or steel pipe some six feet in length was what he found the best

thing from which to suspend the boxes. This method of transport is said to have proven eminently satisfactory in spite of the extremely uneven nature of the country.

The campaign which the United States is at present carrying on in Cuba is also through a country extremely difficult to penetrate, but if a military X-ray outfit could be so successfully transported and proved such a boon in India, there would seem to be no reason why our armies should not also be provided with apparatus of this nature. A short time ago there was some talk of so doing, but whether any decided steps have as yet been taken in the matter we are unable to say. If nothing has as yet been done, the question of providing X-ray outfits should be taken up at once by the proper authorities with a view to giving our wounded soldiers the benefit of this means of alleviating their sufferings.

Under the Searchlight.

Notes and Comments on Various Topics.

THE New York *News Bureau* of the 1st inst. says: "The directors of the General Electric Company held a meeting to-day and took action on the proposition to reduce the common and preferred stock of the company 40 per cent. to correct the impairment of the capital. The officers refuse to make any statement at the present time, but it is understood that a special meeting of the stockholders will be held on or about August 11, to ratify the action of the directors. The notice filed with the Secretary of the Stock Exchange that the books of the company will be closed from July 11 to August 11 gives no reason for the closing, but it is understood to be in order to allow stockholders to qualify for the meeting of ratification."

* * *

IN Turin the other day, according to *Il Osservatore Romano*, a photograph by electric light was taken of the Holy Shroud, which gave an admirable reproduction of the body of Christ. The Holy Shroud was recently exposed to veneration, and King Humbert, who is its hereditary guardian, at first hesitated to give authority to have it photographed lest the photographs should be speculated in. However, His Majesty at length gave the necessary permission to Signor Secundo Pia, a lawyer and member of the Committee on Sacred Art, who had offered to photograph the Holy Shroud at his own expense. Signor Pia prepared his plates according to a special method, rendering them sensitive to the yellowish tint of the Holy Shroud by means of powerful electric reflectors. "Formerly," says the *Osservatore*, "the appearance of the Holy Shroud gave an idea of the contour rather than the facial lineaments and body of Christ. On the other hand the photographs, on being developed, showed a perfect representation of the face, hands and limbs of Christ, the general effect being that of a photograph of Christ and not of his shroud."

* * *

THE Fourth was electrically celebrated in New York and vicinity by a fierce thunderstorm accompanied by drenching showers. Off to the southeast of the city the sky was frequently gashed by great fissures of light that extended from the zenith to the horizon and almost blinded the spectator by its intense brilliance. It was an imposing electrical display and showed what enormous stores of the subtle fluid are held aloft in reserve for future utilization when man shall have learned how to bring them under control.

* * *

A NEW electric clock has recently made its appearance which it is claimed overcomes all difficulties which have existed in timepieces of this descrip-

tion in the past. The movement is said to be extremely simple, consisting of an electromagnet and its armature so arranged as to give occasional impulses to the pendulum whenever an automatic switch closes the battery circuit. These impulses occur at irregular intervals, their frequency varying with the variations in the strength of the current. As the battery weakens, impulses were more frequent, and herein lies the secret of the successful adaptation of electricity to timekeeping. In a recent trial by the United States Government of one of these clocks, at the end of sixty days the timepiece had varied less than sixty seconds.

* * *

IN a thunderstorm on June 28 a bolt of lightning struck the switchboard at Fort Washington which controls the mines in the Potomac River, exploding three mines and seriously damaging the system of electrical connections. This is probably the first occurrence of the kind on record, and emphasizes the need of having suitable lightning protectors on buildings and switchboards controlling submarine mines. In this instance, although several vessels had just passed over the mines that were exploded, no serious damage resulted.

* * *

THE New York *Sun* is responsible for the following instructive anecdote:

The observant Jerseyman and a friend of his were standing out of doors chatting the other evening when they were startled by a sharp flash of lightning in the western sky.

"We're going to have a shower," said the Jerseyman. They listened for an answering peal of thunder, but as none was heard the friend said:

"I guess not; that is only heat lightning."

"There is never any lightning without rain," said the Jerseyman. "My father made that discovery when he was a telegraph operator. That was in the early years of telegraphy, nearly fifty years ago. In those days there was no such thing known as reading by sound and all the operators used recording instruments. The crudeness of the instruments in those days made it very difficult to operate the lines except under the best circumstances, and utterly impossible, even with careful adjustment, when there were electrical storms."

"My father began experimenting to overcome this difficulty, and at last he made a self-adjusting relay magnet which would not only work on any line, long or short, without any manual adjustment, but it would also work just as well when the line wire was overcharged by aerial electricity, and the working of the key merely made slight differences in the amount of current on the line. At these times he could receive messages from any one on the line, although they could not get messages from him, as they had only the ordinary relay magnets."

"His ability to take messages under such circumstances soon became known all along the line. His office was at Perth Amboy, N. J. One day it occurred to him to inquire into this question of heat lightning, and, seeing a storm away off in the west, he telegraphed along the line asking all the offices where the storm was. He got answers from all the offices up to that which was cut off by the presence of the storm, and then requested each office between to tell him when the storm arrived there. So as the storm moved he got a history of it."

"This he repeated many times, and by means of questioning along the line afterwards also made sure that there was always rain falling where the lightning was central every time the flashes were visible to him, although no rain might fall at Perth Amboy for days or weeks."

* * *

OUR contemporary the London *Electrical Engineer*, with its usual dyspeptic fondness for deorying everything that is not of English origin, says: "The Americans cannot resist the Barnum influence in their exhibitions. So at the electrical exhibition in New York an electric wedding has been used as a means of advertisement. The unfortunate bride and bridegroom were married for the good of the show (we trust for their own good also) in the Moore Chapel. The vacuum tubes designed by Mr. Macfarlane Moore provided the light; the organ was driven electrically, and phonographs sang the hymns. Electric carriages were, of course, provided for the couple in question. An electric execution should be the next attraction, with a Spanish spy as the victim."

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY DIRECT CURRENTS.*

BY LOUIS A. FERGUSON,
Chicago.

(Concluded from page 389.)

Municipal legislation in all large cities requires, and very justly so, that the wires for the distribution of electricity for lighting and power purposes should be laid underground. The Edison companies throughout the country use a standard system of underground, the mains and feeders consisting of japanned iron pipe in which are three solid copper wires or rods insulated from each other and from the iron pipe by an asphaltum compound. These pipes or "tubes," as they are commonly called, are 20 feet in length, the copper conductors projecting three inches on each end, making the total length of each pipe 26½ feet.

The copper conductors are connected together by means of a flexible coupling, composed of a standard copper cable about eight inches in length, having copper terminals on either end, and which are provided with a circular opening of such diameter as will permit the reception of the copper conductor of the tube. The copper terminal is heated by the flame from a blow lamp, and the copper conductor is soldered into the terminal.

After the three couplings are connected an iron ball clamp is bolted on to the tube near the end, and a cast-iron oval-shaped coupling box is laid over the copper joint and fastened together by bolts and nuts. The coupling box is then filled with hot insulating compound, and after this has settled by cooling the box is again filled and the opening covered by plugs.

At each street intersection these tubes enter a junction box. The junction box is a cylindrical cast-iron box in the center of which is a cast-iron upright standard carrying three rings of flat copper bar. To one of these rings all of the positive conductors are connected, to another ring all the negative conductors, and to the remaining ring all of the neutral conductors are connected in a similar manner.

Many of the junction boxes are fed by a feeder direct from the central station, the feeder, when Edison tubes are used, being laid in the same manner as the mains before described. The feeders in a three-wire system consist of three conductors, as in the case of mains, with the exception that one conductor which is used as a neutral has usually one-third the area in cross section of either of the two other conductors. Feeder tubes are made in various sizes, from 250,000 cm. up to 3,000,000 cm. Each feeder tube also contains three small insulated copper wires, which are connected in each coupling box to the corresponding wires in the next tube, thus making a continuous circuit from the feeder end in the junction box at street intersection back to the station. At the generating station these wires connect with a pair of voltmeters, and at the end of the feeder they are connected through fusible strips to the copper rings in the junction box, thus giving in the station the pressure or difference of potential at the feeder end. By means of the junction boxes the system becomes one grand network of conductors connected in multiple and fed at many points by feeders from the central station, similar to that of a well designed gas or water system in a large city. By means of this network of mains the electrical pressure is equalized throughout the system and the current is distributed properly among the feeders. Every mechanical and electrical detail of the system is very carefully worked out and absolutely interchangeable, and it is without question, when cables are used for the feeders, the most complete, the most easily operated and most permanent underground system yet devised for the distribution of

electricity for large cities using a direct-current system of 500 volts and under. With this system the customers are almost absolutely certain to have continuous service, as they are fed from two points under ordinary conditions, and should the main in their block burn out it is nearly always possible for the company to feed the customers from one or another junction box. The method of coupling affords a perfect house to house system of distribution, and renders the placing of services a very easy and simple matter. The system is very easily laid down, and its maintenance compares favorably with other methods of distribution.

The maintenance of good pressure regulation at the customer's meter is very much more easily effected with an interconnected direct-current distribution such as has been described than with the ordinary alternating-current central station system, such as has been exploited in this country.

Owing to the parallel operating of direct-current dynamos and distribution systems the fluctuations in the pressure, due to change over from one machine to another, so prevalent in the ordinary American alternating-current central station, and so annoying to customers, are eliminated, and a carefully operated direct-current central station should show a pressure chart with an average deviation from the mean of less than one volt.

It is possible of course and often the careless prac-

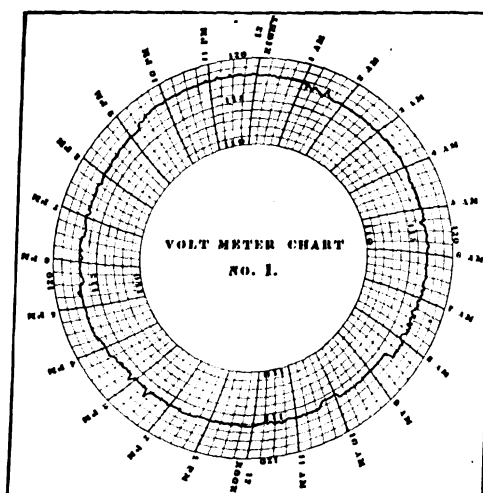


Chart No. 1 represents the pressure for 24 hours on the direct-current distribution system in the business district of Chicago. The average deviation from the main pressure is less than one volt.

tice in direct-current stations to have had fluctuation of pressure at the times of change over, and also irregularities at other periods, but there is absolutely no excuse for their existence in a well operated and well planned direct-current system.

The parallel operating of the generators greatly simplifies the maintaining of uniform pressure regulation at the lamps, since when several units are connected to the common bus-bar the regulation for the entire system may be effected by careful attention to one unit, whereas in alternating current stations where the generators do not operate in parallel it is necessary, in order to even approach the uniformity of pressure regulation which exists in direct-current systems operating in parallel, to regulate the pressure accurately on each unit, which is seldom done in practice. Besides the better regulation possible with parallel operating of the dynamos, a further distinct advantage is derived from the economy effected by proper division of load among the units in the stations, this being particularly marked when the distribution systems are also interconnected. Each unit, irrespective of size, may be usefully and efficiently employed at the period of maximum load, and the amount of idle or uneconomically employed investment is reduced to a minimum.

To illustrate the comparative accuracy of regulation obtainable in an interconnected direct-current system, and in the ordinary type of independent

circuit alternating-current system, let us refer to the pressure charts shown herewith.

If the engineer designing a system employing alternate current in the distribution expects to obtain first-class pressure regulation he must follow those lines laid down by the engineers who have de-

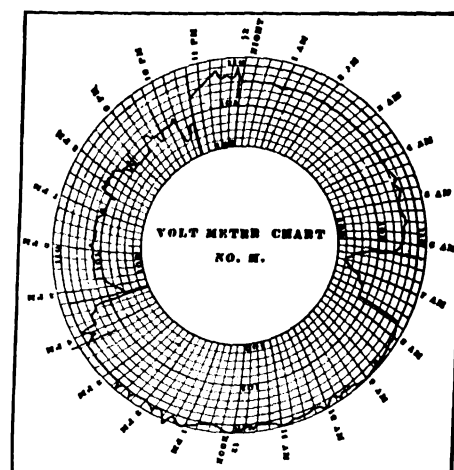


Chart H represents the pressure on one of the circuits of a single-phase, house to house transformer, alternating system in Chicago.

veloped the modern direct-current distribution system. The distribution system of mains should be interconnected, forming one grand network of conductors with large transformers, located at points where feeders would terminate if it were a low tension direct-current system, and to these transformers should be brought the primary feeders from the central station, provided with boosting transformers or induction regulators. Pressure wires from the secondaries of the transformers should be brought back to the station so that the pressure on the ends of the mains may be known and properly controlled. Such a system will be described to you in detail by Mr. Wagner, and I am sure he will agree with me when I say that the single phase, house to house transformer, separate circuit alternating-current system, such as has been generally exploited in this country, has nothing to recommend it to the central station manager, either from a purely engineering or financial standpoint, although it has fulfilled its mission as a pioneer in the introduction of electric lighting in scattered districts.

One of the advantages to be derived from the use of direct-current distribution as distinct from alter-

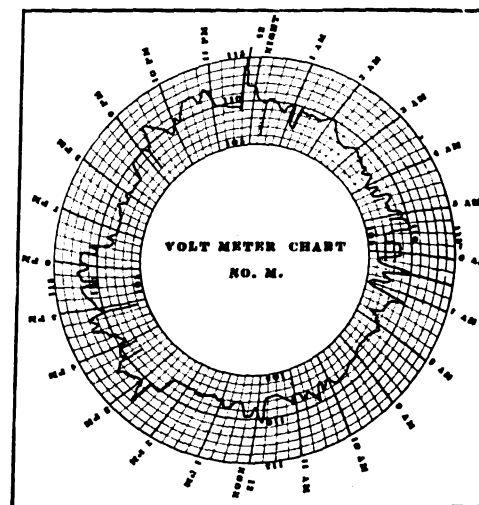


Chart M represents the pressure regulation of an alternating-current system on a long avenue, where are used primary feeders with four 15 kw. transformers, the secondaries in multiple on the three-wire system.

nating-current distribution is the employment of storage batteries. They may be adopted for use in various ways, in sub-stations in outlying districts where the load factor of the district is very small, in the central stations themselves to deliver the entire output during period of minimum load, at the cen-

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

ters of distribution for discharging during the peak, as auxiliaries in rotary transformer sub-stations for discharge use at the time of the maximum load in the main central station. In addition to any one of the various ways which the battery may be employed it always acts as a reserve, guaranteeing the consumer good service, in much the same manner as a bank surplus is a guarantee to the depositors in cases of financial emergency.

Storage batteries when installed in central stations or centers of distribution are usually connected to the main bus and allowed to float on the system, taking a charging current from the bus or discharging into the bus according to the load on the system, the generating units being worked at such load as will insure the best efficiency of the entire system.

Batteries are economically valuable in connection with the distribution of direct current in systems whose load curve has an average peak width of not more than two hours, since the investment required for storage batteries to carry the peak having an average width of less than two hours is less than the investment required in steam and electrical machinery to do the same work. The storage battery also has the same value that exists in the case of moving machinery as a reserve in meeting sudden increases of load, providing such increase of load does not continue for a sufficient period to wholly discharge the battery and insufficient time remain for recharging before the ordinary load peak of the system appears at the regularly appointed time. Such a condition is rarely, and I might say almost never, met with, although in rare instances we may approach this condition.

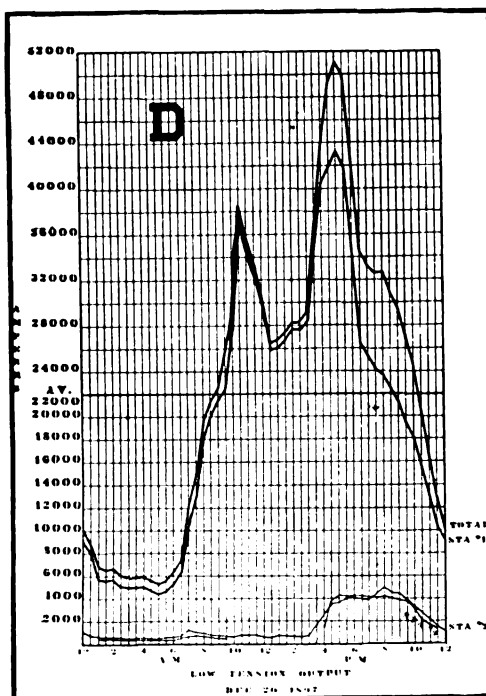
The steam and electrical machinery is rated by the horse power or kilowatt, and the duration of the load peak does not influence the value of the investment since the machinery may be operated for the full twenty-four hours at its maximum capacity. The storage battery, however, is rated by the horse-power hour or kilowatt hour, and the investment is nearly directly proportional to the number of hours during which it discharges the maximum capacity, so that if we required the battery to be prepared to carry the full peak prolonged for seven or eight hours every day the investment in battery would be enormous as compared with steam and electrical machinery to furnish the same kilowatt hours' output. Illustrative of such contingency, let me refer you to the load diagram marked "D," representing the load in the business district of Chicago, December 20, 1897. This is a very extraordinary curve, illustrating the limitation of the storage battery and the possibility of its being rendered ineffective had the early morning peak extended to the arrival of the regular afternoon peak without affording sufficient time for recharging the battery.

The storage battery has a very distinct value, which is seldom recognized and employed to its full advantage, when located at the central distributing point of a system with feeders radiating to various points in the network. The battery may be provided with two or more end cell switches, so arranged that they may be connected in multiple and feed into the main distributing feeder bus, or they may connect also to one or more auxiliary bus-bars with a different number of cells in series feeding into each bus, thus providing two or more potentials at the center of distribution. It will be found when only one pressure is maintained at the center of distribution during the time of maximum load of a large district that the pressure at the ends of the short feeders will be somewhat higher than the standard and they will be overloaded, and at the end of long feeders the pressure will be lower and the feeders underloaded, although the pressure variation at other times may be negligible. Under such conditions the storage battery becomes exceedingly valuable, for by arranging it to operate at two or more potentials the long feeders may be connected

during the time of maximum load to the auxiliary bus or buses and additional current forced over them, utilizing their full capacity and maintaining a uniform feeder end pressure by means of an investment in end cells very light as compared with the investment in additional feeders and mains required to accomplish the same result.

The direct-current distribution system is very much better adapted to electric elevator work than the alternating-current distribution, and as far as I am able to learn there has not yet been developed a commercially successful direct coupled electric elevator capable of running at varying speeds and operated by alternating currents.

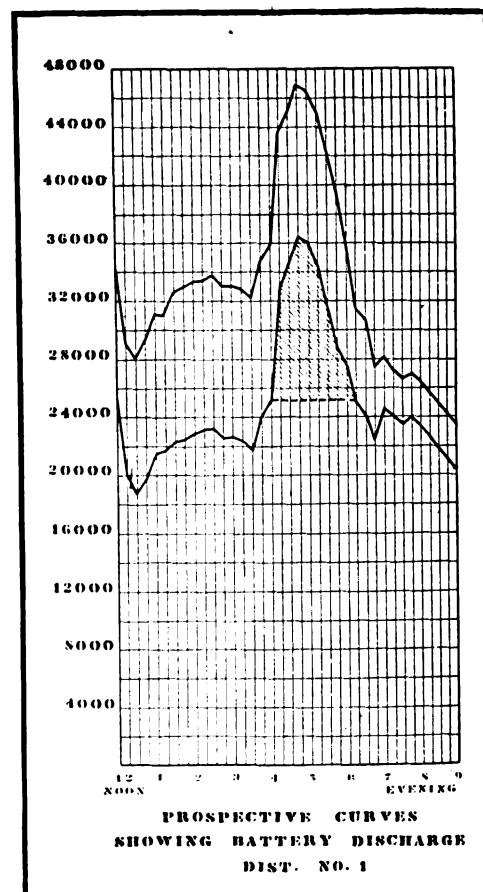
The direct connected electric elevator is a piece of apparatus which is of the greatest value to the central station companies, since it is practically the key to the isolated plant situation, and with its aid we are enabled in a large percentage of instances to show to the owners of large mercantile establishments and buildings a decided saving in the purchasing from the central station company of electricity for lighting, elevator and general power service as compared with the cost of operating an isolated plant using hydraulic elevators. The immense advantage



to the central station companies in being able to supply commercially successful electric elevator service economically may be realized when we consider that there is connected to the systems of the Edison companies in New York, Boston, Brooklyn and Chicago 15,000 horse-power capacity in direct connected elevators, representing a gross income of approximately \$375,000 annually. At the present time alternating current distributing systems confine us to the use of continuous running motors belted or geared to the elevator pump or winding equipment; but such an arrangement is not fitted for first-class passenger service and is very uneconomical, and similar equipments using direct-current motors were in use ten years ago and have long since become obsolete and have been entirely superseded by the direct coupled electric elevator which operates for approximately one-half the cost.

The use of low tension constant potential arc lamps connected in multiple to the distribution system has made rapid strides during the past three years, and in New York, Brooklyn, Boston, Chicago and other cities is fast superseding the use of series arc lamps wherever the low tension mains operate; and the day is not far distant when series arc lamps will be employed only in the outlying districts where there is not sufficient business to warrant the extension of the low tension distribution system. The competition effected by the Welsbach gas burner

has done much to develop the constant potential arc lamp, and it is safe to say that with incandescent lighting alone the central station companies are rendered helpless against the improved gas burners; but a successful competitor has been found in the use of the three and one-half ampere direct-current enclosed arc lamp, and as proof of this we have only to compare the results of the central station companies in the large cities, where these small arc lamps have been employed with the conditions existing in the small towns, where alternating-current systems of distribution furnish incandescent lighting only. In the latter places the Welsbach light is found to be in general use, and is affecting very seriously the earnings of these small central stations owing to the lack of an alternating-current arc lamp which would answer the purpose of the small ampere arc lamp used in connection with direct-current systems. Although very much has been done within the last year in the development of the large alternating-current arc lamp, it is still far from being



in the state of perfection, and cannot be said to compare practically or economically with the constant potential direct-current enclosed arc lamp.

The use of motor cycles and electric cabs employing storage batteries is becoming more popular every day, and in London and Paris they are used very largely, in Paris an Automobile Club having been formed by people owning motor cycles. The central station companies using direct current will undoubtedly find a profitable outlet for their product as the motor cycle becomes more popular, and by locating charging stations for the motor cycles along the central station mains the use of the motor cycle will become more extended.

When we consider the many practical advantages inherent to the direct-current system of distribution which add so greatly to the commercial success of a central station company, it would seem that the original investment required to establish the plant and system should not be the only question affecting the selection of the system to be adopted.

It is universally conceded by all competent and unprejudiced engineers that the alternating-current system of distribution in a closely settled district, which shall approach in commercial value the direct-current distribution system, shall be one which has

for its basis an interconnected system of secondary mains, with transformers of large capacity, and high pressure feeders from the central station to these transformers, and generators in the station operated in parallel, as previously described. Therefore the cost of the distribution network in the case of the alternating-current system will not be less than that of the direct-current network, and the cost of transformers, high pressure feeders and alternating-current dynamos should be compared with the cost of low tension feeders and low tension dynamos of the same capacity, these forming the only points of comparison. The investment in each case depends merely upon the advantageous location of the central station in each individual city.

I have shown in the early portion of the paper that in a large distribution system such as exists in Chicago seventy-five per cent. of the total energy supplied to the system is so nearly adjacent to the desirable location of the central station that a direct-current distribution system should form the basis of the general system of the company.

It seems to the writer that the useful field of operation for alternating-current distribution systems is not in large cities but rather in the scattered suburban residence districts and small towns where commercial lighting, elevator service and general power distribution form an insignificant portion of the demand and where the first cost of the direct-current installation would so far exceed that of the alternating-current system of distribution with primary mains and large transformers for blocks of lighting as to make the interest charges so great that the property would be rendered unremunerative.

The successful central station company of the future will be, as outlined in my paper read before the Association of Edison Illuminating Companies at its last convention, the one combining intelligently the use of alternating and direct currents, employing direct current in the distribution systems in the thickly settled business and residence districts of a city and alternating current for the distribution systems in the scattered residence districts and surrounding suburbs. The energy will be generated at one or two large condensing stations located where water and fuel may be obtained at the minimum cost and the energy transmitted to the various sub-stations located at the electrical centers of the distribution systems. The choice of low pressure direct current or high pressure alternating current for the transmission to the sub-stations will depend upon their relative distance from the generating stations, rotary transformers or other forms of current rectifiers being employed in the sub-stations which supply the direct-current distribution networks when alternating currents are used for the transmission.

Electrical Opportunities in Peru.

The following is an extract from a recent letter by Frank G. Carpenter in the *Washington Star*: "Some of the best things now offered here in a business way are of the electrical order. Lima is a city of 100,000 people, and it has a tramway upon which the cars are drawn by horses. The line of tracks reaches all parts of the city, and the cars, although they are irregularly run and poorly managed, are almost always full. I am told that the roads are now paying, although I could see that the conductors are cheating the company right along and that they do nothing to increase their custom. If this system could be replaced by an electric line it would probably pay well, and might be as big a bonanza as the Mexico City street railways, which sold for \$7,000,000. At present there are two or three American parties who are figuring on the proposition of buying the horse car lines and extending the system from here to Callao and Chorillo, the seaside resort of Lima."

GENERAL DISTRIBUTION FROM CENTRAL STATIONS BY ALTERNATING CURRENTS.*

BY HERBERT A. WAGNER,
St. Louis.

(Concluded from page 392.)

MOTORS.

The greatest argument used against alternating current used to be that it would not run a motor. It has long ago proved that it can, and that without a commutator. This subject now brings us to multiphase systems. There are two of these systems in general use, the two-phase and the three-phase. Other systems are but modifications of these and will be mentioned as such. Motors can be operated with equal facility and efficiency on either system, and have many distinct advantages over direct-current motors.

For long-distance power transmission the three-phase system shows an economy in copper; but for lighting, or for lighting and power combined, it is not at all well suited. I might say that where lighting is a distinct feature, and first-class service is to be rendered from a large station, the three-phase system cannot be used successfully. On even the best generators, the windings are so entirely inter-

tion, as six wires would then be required, forming six circuits that must be kept balanced.

The two-phase system is subject to the same objections unless the two phases are used separately for lighting, in which case we have the complication equivalent to twice the number of generators and feeders.

For good regulation and simplicity, the single-phase system cannot be equaled by any multiphase system.

The so-called monocyclic system is a modified two-phase system in which current is distributed for lighting on a single-phase circuit only, and a third wire carries current in quadrature to the first, which in connection with the first is transformed to a three-phase relation wherever it is desired to operate motors. The regulation of this system can be made almost as good for lighting as the single-phase, and can be as simply effected. The third wire adds complication, but no balancing is required, as all the lighting is done from single phase on two wires. If low-tension, three wire distribution is attempted with this system, a fourth wire must be used for power distribution.

A system practically the counterpart of the monocyclic, is the three-wire, two-phase system, in which

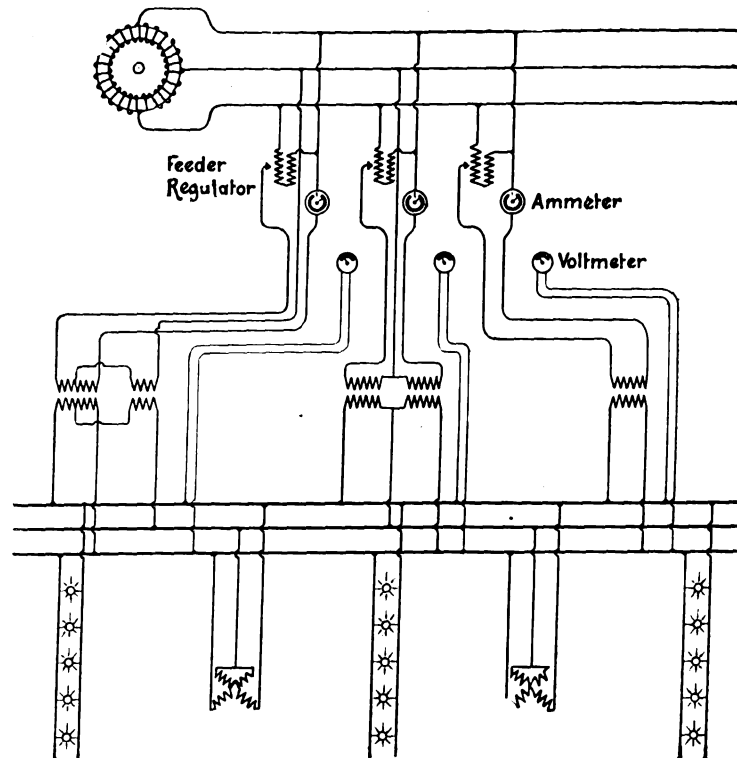


FIG. 3. THREE WIRE TWO PHASE SYSTEM.

with single phase lighting. - High pressure
Feeders & low pressure distribution.

dependent that a change of load on one phase will affect the pressure on the other two; but a defect even worse is the impossibility of regulating the phases independently for drop in the feeders if the load happens to vary differently on any two. Any regulator placed in circuit with one phase will effect about the same change of pressure in the adjacent phase within the usual limits of regulation. Regulation is then a question of the best possible averages, and at best is but guesswork. With the feeder and transformer drops found economical in practice, it would be practically impossible to keep the pressure sufficiently constant for high-efficiency lamps. The complication of wiring is also very serious, especially if the Edison three-wire system is used for distribu-

tion, as six wires would then be required, forming six circuits that must be kept balanced. The lighting is all done on one single-phase, and a third wire is used in conjunction with the other two for power. It is handled in exactly the same manner as the monocyclic system, the only practical difference being in the relative potential of the quarter-phase circuit. In the monocyclic, the quarter-phase element of the generator winding is one-quarter the potential of the main winding, giving between the power line and the main lines a pressure of fifty-five per cent. of that between the main lines themselves. In the special form of three-wire, two-phase, the quarter-phase element of the generator winding is equivalent to one-half of the main winding, which causes a pressure between power line and main lines seventy-one per cent. of that between the main lines. For power distribution, this system requires slightly less wire than the monocyclic. Fig. 3 shows diagrammatically the arrangement of this system used

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

in connection with the special method of distribution already described. The diagram shows a system of two-wire mains for lighting to which might be applied, of course, the Edison three-wire system. The motors used would most naturally be of the two-phase type although three-phase motors may be used with equal facility by the method of transformer connections devised by Mr. Scott.

It can be readily seen that while these systems are much better adapted to general station distribution than the two-phase or three phase, they still lack the simplicity of the single-phase, and both require more wire. Fortunately, we can now obtain single-phase motors which equal the multiphase and direct-current motors in efficiency and almost all desirable points. They start readily with load and may be operated with variable speed; in fact, they equal the direct-current shunt motor in all points, excelling it in efficiency and simplicity.

We can meet the direct current advocates on the power question, therefore, on at least an equal footing, save only one application met in central station practice; namely, the operation of high-speed elevators. The alternating current motor, multiphase or single-phase, cannot be controlled for this work as readily as a compound series direct-current motor. It has taken several years, however, to perfect the mechanism for the control of direct-current elevator motors. Give us the same time, and we will do it with alternating current. This field for power has only of late been opened to direct-current stations, and it is yet a question for debate as to whether it is a paying one.

SPECIAL APPLICATIONS OF CURRENT.

There are many special applications of current met with in practice, most of them bringing a small return, such as electro plating, electro cauterizing, charging small storage batteries, electric heating and cooking, etc. The first three require low-potential currents, and are economically effected only by motor generators or rotary transformers. It is evident that this transformation can be accomplished as readily with alternating current as with direct current. Electric heating and cooking are as yet luxuries, and cannot be depended on for much revenue. They can be done with equal facility by alternating current.

STORAGE BATTERIES.

Here we come to the direct-current advocate's last and greatest stronghold. To this he retreats with great confidence of safety. We may ask first whether storage batteries have yet been proved to be a valuable adjunct to the central station, cost and maintenance considered. It is true they are being tried by several large stations, and we watch eagerly for the results. They equalize the station load to a greater or less degree, and cut down the generator capacity for the peak. Are they, however, cheaper than generators, engines and boilers of the same capacity? Are the losses in transformation less than the cost of a few more attendants? Is their maintenance less expensive than that of generating apparatus? These questions can not yet be answered in the affirmative. But if the battery man's most sanguine hopes be realized, what then? If rotary transformers are good enough for the direct current man to use to change the direct current to alternating current, transmit a good proportion of his load to a distance and transform again to direct current, why should not the alternating current man use them to charge his batteries and then to transform their output back to his pet form of current? Loss in transformation, do we hear some one say? Not any more than with our contemporaries' long-distance transmission system, and, in this instance, they are small and unimportant, we are told. There is at least one station in the country where storage batteries are being used in this way, and I believe with success, as storage batteries go.

Have our direct current friends anything more to bring forward? Or have we forced their last posi-

tion? Well, we will declare a truce, and acknowledge that they fight bravely. We have learned as much from them as they can learn from us. If we had been as quick to acknowledge their beautifully designed distributing details and applications as they have been to appreciate a few of the advantages of our current, we might have been nearer together, or even hand in hand, long ago. As it is, we are both working to the same end, and our paths must join sooner or later as they converge.

Before closing, I wish to recapitulate a little, and draw your attention more forcibly to the flexibility of the alternating-current system. We all know of the many applications to which this current is now put, and what we have described here is, most of it, not new to many of us. The use of the rotary transformer has been widely talked of and described for the last two years. The facility of operating lines at any potential desired, through the means of step-up and down transformers, is no longer an experi-

The great desideratum in central-station practice is to be able to employ one system for everything. All current or all classes of service should be supplied from but one type of generator, be this direct current or alternating current. In this way only can the maximum output be accomplished from a given investment in machinery and apparatus, and greatest economy in operation secured. This has been accomplished in many stations where a limited range of service is to be provided. Arc lighting has, of all, been the most troublesome to provide for. How shall we operate our arc lamps from our incandescent lighting system, has been the anxious inquiry. The constant-potential arc lamp has answered this question for commercial lighting, but city street lighting cannot be so easily provided for. The Edison companies have done a limited amount of this from their three-wire system, but this can be done to advantage only in districts where mains have been provided for commercial lighting. For

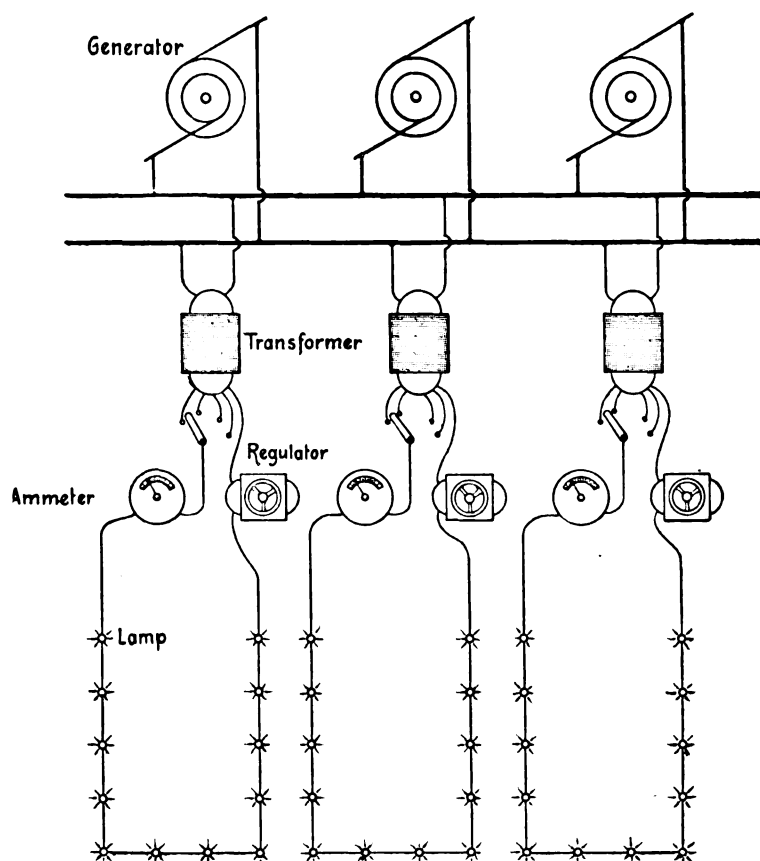


FIG. 4. A.C. SERIES ARC-LIGHT SYSTEM.

ment. Multiphase motors are familiar to all, while single-phase motors have been much talked of and written about, and failures have, time and again, followed boasted success. Many of us, however, have within the last year seen them quietly at work, thoroughly tamed and domesticated. One large station is using them extensively, and is so thoroughly convinced of their success that it has discarded all notion of using multiphase distribution, although it is using generators that can be operated two-phase if desired. Direct-current motors are being rapidly replaced by these single-phase motors to secure uniformity of system.

Arc lamps have been familiar to us on alternating-current circuits for some time, and the alternating current, enclosed, long-burning arcs are now numbered by the thousands. Street lighting is still, however, in most places done on the direct current series system, and even the largest machines yet built for this purpose are very small in comparison with our large direct-connected generators.

extended arc lighting, the small series machine with its belts and clutch pulleys still holds the fort.

I am able to state, however, that one large company has recently solved the problem to its entire satisfaction. This company furnishes 2,600 street lamps to the city, lighting some 300 miles of street. These were operated by a small army of series arc machines. They were installed by a company that was acquired by purchase by the one first mentioned. As this company has long since adopted alternating current for its entire distribution, it was extremely desirable to be able to operate these city lamps from its large direct-connected alternators, thereby saving in fuel, attendance, floor space and reserve investment.

After a few months' trial of an experimental circuit with alternating current, it was found perfectly feasible to operate the same direct-current lamps, slightly remodeled, on the same circuits of sixty or eighty lamps in series. A system of this kind was, therefore, adopted and the company now has 2,300

of these lamps in regular operation by alternating current in this way. The circuits are each provided at the station with a regular step up transformer of a maximum capacity of 4,000 volts and ten amperes, and the feeders to these transformers are treated on the switchboard in the same way as the feeders for incandescent lighting. It is quite usual for one generator to carry 2,000 of these lamps. The lighting is satisfactory to the city, and the lamps give better service than when operated by direct current. There has been a marked saving in fuel and attendance. The indicated horse-power per arc lamp is considerably less than with the direct-current arc lamps operated in the usual manner. Fig. 4 shows this system in diagram.

I know of no other place where this is being done, and it stands as a very pronounced example of the flexibility and adaptability of alternating currents.

There have been a great many problems in the operation of large alternating-current stations that have been discouragingly difficult of solution. The handling of high potentials on switchboards, the operation of generators in multiple, with facility, and scores of more or less important difficulties, have, one by one, been surmounted, the burden of the work usually falling on a few of the pioneer stations.

In summing up, we find the following marked features in which the alternating current, properly installed, has been shown to have pronounced superiority over the direct current:

Highest possible efficiency of distribution and operation.

Best regulation.

Largest territory desired readily supplied from one station.

Comparatively small cost of feeders, effecting enormous saving in investment.

Least cost of real estate.

Cost of installing and operating sub-stations entirely voided.

The only system in which all classes of service can be supplied from one type of generator.

Greatest flexibility.

In closing I wish to thank my friends and co-laborers of the direct-current faith, from several of whom I have had the pleasure of learning much that has proved of great value to me.

ALTERNATING CURRENTS AND DIRECT CURRENTS IN LIGHTING, ETC.

Discussion at the N. E. L. A. Convention at Chicago on Papers Read by Messrs. Wagner and Ferguson on the Above Subjects.

[The papers on which this discussion is founded were begun in ELECTRICITY for June 29 and are concluded in the present issue.]

Mr. Thayer—I would like to ask Mr. Wagner two things. One is in regard to the design of these extremely large transformers. Does he regard it advisable to obtain extremely close regulation; that is to say, a regulation within 1 per cent., or is it better to have a slightly poorer regulation and more iron work? Also, how he does away with the difficulty of the excessive drop in the large conductors carrying the secondary currents proceeding from the large transformers?

Mr. Wagner—In regard to the first question, I mentioned in the paper that by making the transformer practically an integral part of the feeder we eliminate all the effects of the transformer dropping, just as we do our feeder dropping by regulating the pressure wires from the feeder terminal, which become the secondary terminals of the transformer, so that we can sacrifice the regulation of the transformer to secure a very low iron loss; but I want to state further that a poorly regulated transformer is very much better for use in a system where transformers are connected in multiple, provided the pressure for each transformer can be regulated independently. The transformers of very close regulation, 1 per cent. or under, are connected in multiple with two or three hundred feet of mains or more in between. Unless the resistance of the mains is extremely low the transformer will not handle the

load unless it is uniformly distributed along the main. In such a case the transformer nearest the load will take practically all the load, so that for good distribution of load between the transformers poor regulation is desirable, provided that regulation does not affect in general the regulation of the system, and it is so modified it will not do that by making the potential of each transformer to be regulated independently by feeder regulators at the station, manually operated. The changes of loads are slow enough so that one mechanic can take care of them.

Mr. Van Trump—I wish to ask what is the objection to cutting the feeder transformer off the line automatically and saving the underload losses during underload?

Mr. Wagner—The object is to make the underload losses so small that it will not be necessary to do that. That would complicate the operation of the system very considerably both in the matter of attendance and the use of switches and automatic devices, which are not as a rule to be depended on. In the system described here the highest efficiency is at the average load, so that if a transformer was cut out and its feeder was cut out it would decrease the average efficiency rather than raise it, as it would increase the load on the other feeders, increase the copper losses in the other feeders and other transformers, and that increase in copper loss would be greater than the iron losses which you sustain temporarily. The object is to design a system to be most efficient at the average load. With a transformer that can be accomplished successfully.

Mr. Robinson of Baltimore—What is the wattless current loss?

Mr. Wagner—The wattless current is inappreciable. The volt amperes and the watts correspond to nearly in any alternating station at full load that the increase is almost inappreciable, even in the most poorly designed station. The power factor is very high at maximum loads, and with a system of this kind the power factor should be practically 100 per cent. at all times, except for alternating motors, which lower it slightly. The part of the load that comes on the peak is principally incandescent lighting. The motor load is almost constant and the arc lighting load is much more nearly constant than the incandescent load. The wattless current is small compared with the other currents in any event, and it is found in large alternating-current generators that they can be operated with a considerable increase of current in the armature without materially increasing the temperature of the machine for short periods, as the greatest losses in the generator do not originate in the copper of the armature and that can be very greatly overloaded without affecting the maximum value of the machine.

Mr. Dow—I desire to discuss Mr. Wagner's paper to some extent from the point of information furnished in the paper itself. He states the feeder loss in case No. 1 of the table giving the data on which his curves were plotted is 24 per cent. That is an exceptionally high feeder loss. It is not radically different from the feeder loss in Mr. Ferguson's paper, 22.8 per cent., but that includes the tie line losses over an Edison three-wire station located much further from the maximum load than is customary. I think that taking the average of Edison stations, and this is assumed to be a representative three-wire direct-current station, the feeder loss is more nearly 12 to 14 per cent. I am familiar with one station where the feeder loss is under 12 per cent., others 15 per cent. As to the 24 per cent. loss I cannot think of any station, except possibly the Chicago station with their tie line included, where the feeder loss would approximate that. A slight modification in the feeder losses will completely change the pressure of the two currents, Nos. 1 and 2. It will place No. 1 above No. 2 throughout its entire length as shown in his Fig. 1. I think that 24 per cent. loss in general will bring the cost of the feeder itself, particularly the cable feeder which is now standard, to not much more than the cost of feeder transformers, which Mr. Wagner proposes to employ. The transformer with a cable feeder capable of carrying 100 kilowatts can be bought for something like 90 cents a running foot; that is of course cheap construction, but it is a good figure to compare with the cost of a transformer which is proposed to be used in place of and to avoid the great expense of that feeder. A transformer for 100 kilowatts will cost \$1,000 to \$1,200, and the initial advantage of the thousand dollars in favor of the direct current system will pay for a great deal of copper, and the permanency of the one investment as compared with the other is much in favor of the direct current.

Taking again the figures alluded to, the loss in mains is assumed to be 2 per cent. in both cases. Now I rather take exception to that with the conditions of load which will prevail in such a station as the representative Edison station, viz., with a large

motor load and very respectable arc lamp load. Under those conditions the fact which Mr. Wagner has noted in his paper, that the drop in the alternating current main or feeder is not proportional to the current, which he sets forth as follows: "It would be quite perfect if the drop in alternating-current lines were proportional to the current, but it is not," will certainly affect the quality of the investment between mains for direct current and alternating current. To get the 2 per cent. regulation in the mains will certainly under the conditions of the representative Edison station involve considerably more investment if the supply is to be by alternating current.

The question as to arc lamps as discussed by Mr. Ferguson, and the statements made in his paper, can be applied directly to answering Mr. Wagner as to the quality of the two systems in these respects; and I wish to accentuate strongly Mr. Ferguson's statement that the electric elevator, which Mr. Wagner says is just now a difficult and unsettled problem for the alternating-current station, is of primary importance to central station interests. If you are not able to give good elevator service you will have to submit to the establishment of many isolated plants. It is a strange sequence that if a man has to keep an engineer on his premises, a steam boiler and a steam pump for the purpose of running a hydraulic elevator, he will add a dynamo and an engine to supply his own light. On the other hand, if you can furnish him good elevator service at a reasonable rate the necessity for the engineer and for the high pressure steam is eliminated; and in that very point lies the possibility of blocking the establishment of isolated plants. In my case to lose the elevator service would not be a serious matter as far as the elevator bill is concerned, but the incidental loss due to a good deal of valuable lighting would be very serious indeed.

I should say that Mr. Wagner has shown what a great many others knew, that the alternating current service can be wonderfully improved above its customary standard that it can be brought up closer to the standard heretofore set by the direct-current stations; but that it is still, except in most exceptional stations, an inferior service for the condition which Mr. Wagner has defined as those of the representative Edison three-wire central station. In the case of a densely populated district demanding the greater portion of the total supply the direct current is unquestionably the best; a less densely populated section might be supplied by the alternating system, or it can be supplied, as Mr. Ferguson has suggested, by an alternating distribution and direct current.

Mr. Wilmerding—Referring to the question of the drop in the feeder on the No. 1 curve in Mr. Wagner's paper, I would ask Mr. Ferguson if his statements in which he says that the drop on the trunk line was 12.4 per cent., and to the customer's meter 2.8 per cent., does not include all the losses; that is, include all the losses that might be made in the feeders themselves?

Mr. Ferguson—That includes simply the volt drop and does not include the losses at the meter. That is the loss at the time of maximum load, and is not the average loss. That is given as 8.8 whereas the maximum loss is 22.8, and that includes the total losses from the station to the customer's meter, including all the trunk line losses and the main. In line with the partial answer to that question, and to help out Mr. Dow in what he was saying, I can furnish a curve that illustrates the point he brought out. I have a curve that represents a typical central station, such as has been referred to by Mr. Wagner in the general remarks in his paper, and represents what Mr. Dow refers to.

Prof. Goldsborough—In being permitted to make a few remarks on the papers presented, I should like to say in connection with Mr. Wagner's paper in reference to the sub station transformer, it seems to me that there is an opportunity to improve the low-load efficiency of a plant. I notice from the curve that he has the load falling off and down below the direct current curve, for that is less than 8 per cent. That loss must be due to the inefficiency of the transformer, because the only difference between the two systems is in the transformer, the copper being the same, and the iron loss is the important factor. He said that the iron loss is so small, as his figure indicated, that it is not an appreciable quantity. It seems to me, however, that a system of sub-stations could be devised and a number of transformers placed together, and a set of feeders could run from the central station to the sub station, and some of the transformers could be cut out, that there would be a gain there, and a certain number of the feeders would be used in common with a certain number of transformers. In that arrangement you would have less core losses, and consequently you would have improved efficiency at the

lower load. That improvement I think would be noticeable from about 25 per cent. of the load on down to a very low load, and might be a considerable quantity, for the reason that as the load goes off the power factor of the large transformer comes into play. If you could cut out some of the large transformers, and have a few of them fully loaded instead of many of them partially loaded, you will improve the power factor of the whole distributing system, and thereby gain a great deal, because as you reduce the power factor you reduce the volume of current to supply a given amount of current. As to the means of cutting out and cutting in these transformers, that would be a matter of considerable expense and you would have to employ a man for that special purpose. Such a system can be devised. It might be a system of relays by means of a small wire; you could send out a line from the central station to the sub-station and operate it by a relay electro-magnetic device which will throw in or throw out the switches for the transformers on the transformer primary.

I was much pleased to hear Mr. Wagner express himself so strongly in favor of the single-phase alternating current. The single-phase alternating current possesses the same features of simplicity that are possessed by the direct current, to my mind. In connection with the arc light it was said a few moments ago by some one that the alternating arc lamp has found a rival in the Welshbach burner. It is said that we do not supply the arc light as cheaply as the light can be supplied by means of the mantle. I think that is not altogether so, for the reason that the gas light is becoming unpopular in the East. It is not at all suitable for interior lighting and won't do at all for entertainments, as it makes everything ghastly whereas the arc lamp gives a steady light.

Mr. Scovil—In Mr. Wagner's paper occurs this statement: "I might say where lighting is a distinct feature, and first-class service is to be rendered from a large station, the three-phase system cannot be used successfully." If there is any technical gentleman who takes an opposite view on that question I hope he will give us the benefit of his experience and judgment.

Mr. Rice—I wish to say in discussion of the two papers, that it seems to me the feature is brought out that we are comparing two systems, one of which is brought to a high state of development and one of which is just beginning to be developed. I think Mr. Ferguson's example of the alternating plant is very unfortunate, in that it does not represent an alternating plant of the latest design. It is now past discussion that alternators may be thrown in parallel the same as continuous-current generators. The use of motors is another feature which is coming into prominence. The alternating-current motors have not been developed and applied the same as continuous-current motors, simply because they have not lived long enough. In time I expect to see alternating-current motors distributed as widely and as universally as continuous-current motors.

Mr. Pillsbury, St. Louis—I wish to say a few words in regard to the alternating-current motor, having been identified for several years with the development more especially of single-phase machines. The question has been raised as to their power factor by one gentleman, as to their practical success by another, and as to their adaptability for the direct driving of elevators by several. Single-phase alternating-current motors are now made equal, if not superior, to direct-current motors for general power distribution. The power factor in a well designed machine may be considerably above 90 per cent., from 50 to 150 per cent. of its rated capacity, and above 80 per cent. while the motor is developing 20 per cent. of its rated output. For general power distribution these are superior to direct-current motors in point of care and attendance required, average efficiency, absence of wear, etc. To the direct driving of elevators they have not as yet been applied, but there is no reason why they cannot be adapted to this work as soon as a sufficient demand shall have arisen. The only problem met with in their application to this class of service is that of starting. There are two methods of doing this, one by splitting the phase and another by introducing a commutator. Either of these is entirely successful.

Mr. Insull—Gentlemen, I operate a company which is in no sense wedded to one system or another. Within the last week I have shut down a three-wire Edison system. I would like within the next week to shut down an alternating system. With us it is simply a question of the most money we can possibly make out of a given investment. I think if you will study Mr. Ferguson's paper you will find that he has gone into this question not merely from a theoretical point of view, but his observations are based on the actual results obtained in a year's operations of a large property. This property has been in existence some ten years. If you

study Mr. Wagner's paper you will find that he presents to you for use in our large cities—as his paper is based upon operations in a large city principally—a new scheme that has not stood the test of time, and that cannot be set up in comparison with the low tension system until a company under Mr. Wagner's plan has developed their business to a point where you can make a comparison of investment with investment, expenses with expenses and return with return. I know that most of you gentlemen here are alternating men, and that you look upon me as a low tension man. But I would remind you that exactly what Mr. Wagner has stated this morning with relation to the advantage of an alternating distributing system as against the present three-wire system was stated, for different reasons of course, with relation to the alternating house to house system that you are now using as against the three-wire system some ten or twelve years ago. Now what has been the test of time? The manufacturer used to tell us ten years ago that alternating current generation, house to house converter distribution, meant a very much lower investment cost to the parties providing the money. Exactly the contrary has been proved to be the case in any large center of population where there is much business. It has also been proved that in the smaller centers the losses are so great that some such scheme as Mr. Wagner propounds is absolutely necessary if you are going to sell electricity in competition with other forms of artificial illumination. I do not know that I am competent, in fact I do not care to go into the slight differences that are shown by Mr. Wagner's percentages on one hand and Mr. Ferguson's absolute figures on the other hand, and the slight difference of economy which Mr. Wagner claimed. What I would like to know from Mr. Wagner is whether he has a statement of his generated output for a year, and his delivered output for a year, and what is the difference between the two, and how closely they compare with the percentages as stated in his paper. I would like to know at the same time how he has obtained a record of his generated output. I tell you, gentlemen, that the Chicago Edison Company cannot swear to any absolutely correct output at the present time, and the differences of efficiency claimed by Mr. Wagner might possibly disappear in the personal errors that might enter into the calculations. There is one thing you must remember about the low tension distribution system. I assisted in laying the first conductors for a multiple-arc central station system in New York, and the only change that has ever occurred in the distribution system is the change from the two-wire to the three-wire system. If the Chicago Edison Company could profit by the adoption of Mr. Wagner's scheme (and I doubt whether Mr. Wagner would claim that), the only changes we would have to make would be in our feeder system, and those changes would depend on whether our insulation would stand the high voltage. Our distribution is a permanency; it has not changed from year to year to my certain knowledge since 1884. We have not been trying first one translating device, then a new system of distribution, and then another translating device, all of which pile up big interest cost. We have been working on the same lines; and I would like to ask Mr. Wagner if the city of St. Louis, in which he has done such remarkably good work with the alternating current, had started first of all in the central portion of the city with an Edison three-wire system whether he would have any reason to change it to-day.

Mr. Wagner made some facetious remarks about those "beams of copper." Those beams of copper earn a return for my stockholders. As to whether you shall have beams of a certain size is simply a question of interest cost, fuel cost, and other incidental costs under varying conditions. With fuel very low an Edison man would naturally decrease the size of his beams. With fuel very high he would naturally increase the size of his beams. It is a question of balancing the interest cost against the other portions of the cost, and the size is simply an incident in the matter. Mr. Wagner referred to the use of storage batteries. I may say that I agree with him to some extent. He says in his paper that you may ask as to whether storage batteries have not been proved to be a valuable adjunct to the central stations, cost and maintenance considered. I would ask him whether his proposed system of alternating distribution has yet been proved to be a more valuable adjunct to the central station as compared with the three wire low tension system. So far as the Chicago Edison Company is concerned and its use of the storage battery, as the battery only went into use yesterday we are not in a position to say much about it at the present time. We are to some extent trying an experiment; but I can say this, that one of the primary reasons in our deciding to use a storage battery was the difference in the investment

costs between the battery and the construction of a trunk line that would have had to take its place. That is an important factor, as I said before. Interest cost comes in in all these matters. It is a question of conditions.

Now as to Mr. Wagner's closing claims. The first is—highest possible efficiency of distribution and operation. I judge from that that Mr. Wagner means the cost of distribution and operation will be lower in the alternating-current system than in the case of a three-wire system. My claim is that that has to be proven. The next claim is: largest territory desired readily supplied from one station. There comes the question of investment. It is simply a question of conditions. The greatest claim is flexibility. If you can find anything more flexible than a system operated during the whole of the 24 hours, first from one station, then from two, then from three, carrying at the same time during the 24 hours current 13,000 feet from the point of generation with a loss almost impossible to figure out—if you can find anything more flexible than that, we will be delighted to adopt it.

Another claim is: the only system in which all classes of service can be supplied from one type of generator. I take issue and challenge him to show a plant in operation where that condition exists, except in the case of the low tension direct three-wire system. I have not seen it. I think it was Mr. Bowker, vice-president of the Edison Illuminating Company of New York, when we first started to discuss this question of the use of alternating current in connection with the low tension Edison station, pointed out the absolute permanency of the main investment in low tension work—that is, the distribution system; and although Mr. Wagner may be correct in the claims he makes as to percentages of efficiency—on that subject I am not competent to offer an opinion—I would warn you to go very carefully, certainly in large cities, about adopting a scheme over one that has received the test of time. So far as widely distributed areas are concerned there is no doubt that the alternating current is of great advantage to us, but in big centers of distribution I think that the experience of electrical engineers the world over has shown that the one system to use, one by which we can make money and which will enable us to keep our positions, is the use of the low tension Edison system.

Mr. Ayer—The discussion resulting from papers like these, so far as it has gone, largely relates to the practice in large cities. The membership in the Association, however, is not made up of representatives of large cities entirely, and the discussion of the papers should take a trend that would benefit the greatest number, and it seems to me there is ample food in these two papers to give us some lessons that will apply to all. One thing that I think is pretty generally understood by the operators of central stations in the last few years, is the necessity of getting rid of the house to house transformer, which means going to the three-wire distribution. We are all working for that end. It seems to me now from this discussion that it is the thing to come to; in other words, that method of distribution is best that produces permanency of investment and leads up to some one settled method for detail of our plan. The motor business is coming to be quite a factor as you appreciate. The alternating current motor, while not developed to its highest efficiency and not so well known, may have great possibilities, but it is not going to exceed the possibilities of the direct-current motor. The question of the flexibility of the current, while it is not so much a question to-day as it was five or ten years ago, is still very important. The point has been raised about hydraulic elevators in medium size cities cutting off desirable sources of revenue. Printing presses are very troublesome to the alternating-current motor man. There are other special uses and demands, but we know this in regard to the relative value of these investments—you have to make some experimental investments to-day in the alternating-current motor—you have the question of insulation to contend with, and in all high tension devices as you get up in pressure you decrease the life of the devices and the investment is of a less permanent nature. The character of the services that you could get from the one or the other is varied. It is certain that you can get good regulation with the direct current. It is easier to regulate the low pressure system than the high, but the question is to get the thing that will bring you the greatest amount of business at all times, and that is a question which is a pertinent one. The low tension system certainly does that. While we have the statements that a perfectly satisfactory single-phase motor is in the market we know they are not in general use. Many of the members have experimented with them. There is no question that they will come and be satisfactory, but they are not comparable to the direct-current motor

to-day. Isolated plants will invariably put in in the future as in the past the direct current and you will lose sight of the possibility of a large amount of business if you extend your alternating system rather than to extend the system with direct current. The arc lighting problem to me is one that is readily solved with the direct system, and for outlying districts and municipal lighting there is no question in the mind of any one who has ever attempted to compare the alternating current with the direct current for street lighting from series or multiple arc lamps, that the very nature of the current makes it a certainty. You get the strongest rays where they are useful; no reflectors are necessary to carry it down. We know the enormous investment we would have to put into apparatus incident to developing the alternating-current system. All translating devices are easily destroyed and they are expensive to replace.

I had thought to touch in detail on some of these statements relative to the comparison of the two methods, but it does not seem necessary. Where alternating current only is practicable and there are conditions where a central station should use it, it goes without saying that the method outlined, or substantially that, is one which should be taken up wherever the conditions warrant it; but I want to express my conviction very firmly that the old system is the best one.

The discussion was continued by Messrs. Fakes, Davis, Stetson, Van Trump, Ferguson, De Camp, Insull, Hubeley, Thayer, Chandler, Smith, Walbank and Carnes, and was principally in reference to details not entered into in the papers of Messrs. Wagner and Ferguson.

FIFTEENTH GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The Fifteenth General Meeting of the American Institute of Electrical Engineers began its opening session at Omaha, Neb., at 10 A. M. Monday, June 27. Through the courtesy of Mr. Rosewater, of the Omaha Bee, a large, cool assembly room on the top floor of the Bee building was placed at the disposal of the Institute throughout the Convention. The opening session was called to order by the president, Dr. A. E. Kennelly, who announced that, the mayor of the city being absent, the president of the City Council, the Hon. W. W. Bingham, had been deputed to receive the visitors.

Mr. Bingham extended a cordial greeting, and assured the Engineers that during their stay our few would not ring till 3 A. M., so that plenty of time would be afforded to do the Midway properly. He closed by presenting the Convention with a golden key to the city. President Wattles of the Exposition was then introduced and welcomed the Society to the Exposition and extended the courtesies of the grounds to them. Mr. Wattles expressed his appreciation of what his electrical engineers had done for his big show and insisted that the lighting effect of the Grand Court at the Trans-Mississippi Exposition would take second place to nothing, not even the Chicago Exposition. Mr. Edward Rosewater was next presented and spoke in a reminiscent strain of his early experience in telegraphy.

President Kennelly next delivered his inaugural address, on "The Present Status of Electricity." This was followed by a paper entitled "The Dielectric Strength of Air," by Charles P. Steinmetz. The secretary next read a paper in the absence of its author, Mr. Howell, on "Two-wire Distributing Systems and Lamps of 220-240 Volts." This gave rise to an interesting discussion in which many members participated, and was one of the most instructive features of the session. "A Capillary Electrometer for Electrical Measurements" was the last paper to be read by its author, Charles F. Burgess, and was favorably received.

On Tuesday morning, after the meeting had been called to order, a paper by George A. Damon on "A Modern Electric Central Station" was read and was followed by a discussion in which Messrs. Arnold, Steinmetz and Humphrey participated.

The "Preliminary Report of the Committee on Standardization" was next presented by Dr. Crocker, the chairman of the committee. The general discussion of the report followed, which occupied the remainder of the morning session.

At the Wednesday session a paper by Albert H. Armstrong on "Some Phases of the Rapid Transit Problem" was read, which was followed by a paper on "Transmission and Distribution of Power for Railway Service," by Ernst J. Berg. Both papers were quite fully discussed. A paper on telephonic disturbances in Minneapolis was then read by Prof. G. D. Shepardson of the University of Minnesota.

During the afternoon of Monday, the opening day, the Convention visited the Omaha and Grant Smelting and Refining Company's works, also the Union Pacific Railway Company's shops. The smelter is the largest in the world and the trip through it proved quite interesting and profitable. Master Mechanic Manning of the Union Pacific personally conducted the men through his shops.

Col. J. J. Dickey, of the local committee, at the Monday morning session announced that the Knights of Ak-Sar-Ben would hold an honorary initiation in the evening for the A. I. E. E.'s. All who desired to take the oath of allegiance to King Samson IV were to meet at the "Den" at 8 P. M. Fifty men were at that morning meeting and fifty men knocked humbly at the gate of the King's palace in the evening. Sixteen entered the lists to gain special favor in the eyes of the King, and the rest stood by and enjoyed the efforts of the favor-seeking sixteen. Since the new subjects were electricians, it was thought no more than proper to turn the "juice" on a little stronger than usual in the machines fitted up to shoot lightning through candidates.

The afternoon and evening of the second day were spent in a complimentary trip to the Exposition. When night fell the lighting of the main court was admired, and then the trip down the Midway began. The crowd escaped from the delirium of the "Streets of All Nations," crossed the way and remembered the Maine long enough to see it blown up, and then found their way to the "German Village." The hospitable manager and his beer were too much, and there the crowd stayed till the lights went out.

An excursion to South Omaha was the programme for Wednesday afternoon. A visit to the establishments of the Swift and of the Armour companies gave the visitors some idea of the extensive packing interests of the Magic City. In the evening, through the kindness of the several managers, the Convention enjoyed a trolley party through Council Bluffs, South Omaha and Omaha.

Before adjourning, the Convention extended its unanimous thanks to Prof. Owens for his untiring efforts in the local committee on arrangements. The following resolutions were also unanimously adopted:

Whereas, The American Institute of Electrical Engineers at its first general meeting west of the Mississippi has been received with cordial hospitality and every endeavor has been made to contribute to the convenience and pleasure of its members:

Therefore, the Institute formally expresses its hearty appreciation of the many favors and courtesies which have been extended by its generous hosts in exhibiting the remarkable industries of Omaha, in presenting the beautiful "White City," which represents the progress and enterprise of the Trans-Mississippi West, and in many ways doing honor and contributing to the welfare of the Institute. In especial measure thanks are due to the city of Omaha, through its Acting Mayor Bingham; Mr. Rosewater for courtesies extended; Mr. Wattles in behalf of the Exposition, and also Mr. Kirkendall of the Department of Buildings and Grounds, for special attentions; the Omaha & Grant Smelting & Refining Company, the Union Pacific Railroad Company and Master Mechanic Manning, the Omaha Street Railroad Company, the Omaha and Council Bluffs Railroad & Bridge Company, Swift & Co. of South Omaha, Armour & Co. of South Omaha, the Knights of Ak-Sar-Ben, and the members of the untiring local committee.

The following is a list of names of those in attendance:

Abbott, Arthur Vaughn, Chicago.
Armstrong, A. H., Schenectady.
Arnold, Bion J., Chicago.
Bart, F. B., Chicago.
Berg, Ernst J., Schenectady.
Bingham, W. W., Omaha.
Burgess, Charles F., Madison.
Creighton, Hon. J. A., Omaha.
Crocker, Francis B., New York.
Damon, George A., Chicago.
Dickey, J. J., Omaha.
Dimmock, W. S., Omaha.
Drake, Luther, Omaha.
Eddy, Dr. H. T., Minneapolis.
Ekstrom, Alex., Schenectady.
Frankenfeld, Budd, State College, Pa.
Fuller, C. O., Omaha.
Goldsborough, W. E., Lafayette, Ind.
Hammeroblag, A. A., New York.
Harris, G. H., Birmingham, Ala.
Hubbard, Freeman, Minneapolis.
Horton, C. B., Omaha.
Howell, John W., Newark.
Humphrey, H. H., St. Louis.
Jackson, D. C., Madison, Wis.
Kammeyer, C. E., Chicago.
Keller, E. E., Pittsburgh.
Kennelly, Dr. A. E., Philadelphia.
Kerr, H. H., Chicago.
Korty, L. H., Omaha.
Lane, H. Van, Omaha.
Lindsay, W. E., St. Louis.
Lovett, Israel, Omaha.
McKissick, A. F., Auburn, Ala.
Morgan, Jacques L., Kansas City, Mo.
Murphy, Frank, Omaha.
Nash, F. A., Omaha.
O'Hara, J. B., Chicago.
Owens, Prof. R. B., Lincoln, Neb.
Pope, Ralph W., New York.
Reichmann, F., Austin, Tex.
Rogers, A. S., Omaha.
Rosewater, E., Omaha.
Rosewater, Andrew, Omaha.
Rustin, H., Omaha.
Scott, C. F., Pittsburgh.
Shaw, H. B., Columbia, Mo.
Shepardson, George D., Minneapolis.
Shurig, Edward F., Omaha.
Steinmetz, Charles P., Schenectady.
Stieringer, Luther, New York.
Umsted, W. W., Omaha.
Wattles, G. W., Omaha.
White, William F., Omaha.
Woolbridge, J. E., New York.
Yost, C. E., Omaha.

MEETING OF THE CANADIAN ELECTRICAL ASSOCIATION.

The Canadian Electrical Association held its annual meeting at the Windsor Hotel, Montreal, on June 28, the attendance being unusually large.

The Association was welcomed to the city by His Worship Mayor Prefontaine, who was introduced by Mr. Sadler, after which Mr. John Yule of Guelph, the president of the Association, delivered the customary presidential address. The first paper to be read was "How to Overcome Some of the Difficulties Encountered by Central Station Men," by A. A. Wright of Renfrew, Ont. Mr. Wright's paper contained many valuable suggestions on this subject from the standpoint of one having to deal with customers living in a town of moderate size. The paper was distributed. The meeting adjourned at noon to resume again at 2 o'clock. Another large attendance greeted the second session and much enthusiasm was displayed in the proceedings.

A paper on "Electric Utilization of Water Powers," prepared by L. D. W. Magie, was read by W. H. Browne, and read so well that it was humorously suggested that Mr. Browne should accept the position of official reader for the Convention.

Mr. Magie's paper dealt with the desideratum to be attained in making use of water power as a power for generating electricity at a profit; and as the relative merits of steam and water were incidentally involved in the argument, considerable discussion afterwards arose on this point.

After Mr. Reeser, E. E. Wright, Mr. Wickens and

others had spoken briefly, the suggestion to defer Mr. Magie's paper for discussion to next year was adopted, and it was received with a cordial vote of thanks.

A rather remarkable paper was that read by W. T. Bonner, entitled "A Plea for the Introduction of Goods Traffic on our Suburban Tramways."

Mr. Bonner drew attention to what he conceived to be an important field for development in tramway enterprise, after which he proceeded to expose the scheme of his paper. This, in a word, was that suburban tramways should acquire facilities for carrying farm produce in the wagons as freight on the roads, thus reducing the cost of carriage and saving the farmer the long and tiresome journey by horse and wagon to get to market.

After quite a lengthy discussion on this subject, on motion a vote of thanks was tendered to Mr. Bonner for his paper, and the meeting adjourned until June 29 at 10 o'clock.

After the meeting had been called to order on June 29, C. H. Mortimer submitted his annual report, and considerable routine business was gone through with, it being decided among other things to hold the Convention next year at Hamilton. James Milne's paper on "Economies in the Boiler Room" was read at this session by Mr. Weeks. W. T. Bonner read a paper on "The Quimby Screw Pump," which it was claimed offered a wider range for the utilization of electric power than any other apparatus presented for some time past, and in a field also where costs of installation and operation are both important factors.

The other remaining papers were taken as read, and the Convention adjourned.

E. M. F. of the Arc With Aluminum Electrodes.

It is known that an electrolytic cell having carbon and aluminum electrodes opposes the passage of current in the aluminum-carbon direction with an EMF. of 22 volts, while current passes in the other direction with only the opposition due to the resistance of the liquid and the polarization EMF. Herr V. von Lanz describes in *Wiedemann's Annalen* his researches upon the arc with aluminum electrodes.

This arc is established under an EMF. of 19 volts. Between electrodes of aluminum and carbon the current passes more easily from aluminum to carbon, an effect contrary to that noticed in the electrolytic cell. This arc may be used therefore for the rectification of alternating currents, but the efficiency of such a rectification would not be higher than about 6 per cent.

LEGAL NOTES.

A recent decision of a New York court is of importance to street railway companies. The case was one of a collision between a street vehicle and a trolley car, and grew out of an action for damages on the part of the owner of the vehicle. It appears that the vehicle was traversing a street crossing the street railway track, and that while so doing it was struck by a car and badly damaged. The defence set up the plea that the car had the right of way, and that it was the duty of the driver of the vehicle to recognize this fact and stop his horse to let the car go by. The court held that this defence was erroneous; that a street railway company in acquiring the privilege to lay rails along the streets for its traffic was not given any exclusive privilege, and that it was the duty of a motorman at all times to be as careful and as watchful in avoiding collisions with horse drawn vehicles as the drivers of such vehicles should be in avoiding collisions with the cars. In other words, that street cars have no special privileges other than the right to require that vehicles shall not impede their progress along the streets they traverse.

A bill in equity has been filed in the United States Circuit Court at Philadelphia by the Edison Electric Light Company against the Lancaster Elec-

tric Light, Heat & Power Company, and Isaac C. Walker and Henry G. Keppler, trading as Walker & Keppler of Philadelphia, asking to have the defendants restrained from the making of an alleged infringement on the plaintiff's patent upon an improved system of electrical distribution.

Justice Scripture in special term at Syracuse, N. Y., on the 25th ult., after hearing argument on a motion made by Attorney Bronner, of Little Falls, dissolving the Dolgeville Electric Light Company and appointing a receiver therefor, named James D. Feeter of Little Falls as receiver. The electric light company is one of the concerns involved in the failure of Alfred Dolge & Sons.

Judge Valiant has denied the writ of mandamus asked for by George H. Little of St. Louis to compel the officers of the St. Louis Electric Railway Company to permit him to see the books of the company. The company was organized some years ago to build an electric road between St. Louis and Chicago. The road was not built.

The Volunteer Engineers.

Company F, First Regiment U. S. Volunteer Engineers, was mustered in at Camp Townsend, Peekskill, on the afternoon of the 4th. Among those designated electrical engineers or electricians on the muster roll are: Sergeants—Francis M. Blacklock, Niagara Falls; George C. Ewing, Newton, Mass. Corporals—George B. Gordon, New York; William J. Schweiger, New York. Musician—Warren S. Fisher, Ridley Park, Pa.

Help to fight the Electrical Trust by subscribing for **ELECTRICITY.**

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Bunker Hill, Ill.—The electric light ordinance has passed the council by a unanimous vote. Bonds will be issued to the amount of \$6,900 and the proceeds applied to the erection of the plant.

Decatur, Mich.—The committee appointed to investigate as to cost and advisability of putting in an electric light plant have reported favorably to the project, and recommend that a plant to cost about \$6,000 be obtained. The system will be for both arc and incandescent lighting.

Fargo, N. D.—A franchise has been granted to Alexander Hughes and Elmond A. Hughes of Bismarck to operate an electric light and power plant in Fargo. The term of the franchise is twenty years.

New Richmond, O.—P. Arlund & Co. have been granted a franchise permitting them to erect an electric light plant in this town of sufficient capacity to supply 33 arc or 150 incandescent lights for street lighting.

Oshkosh, Wis.—An ordinance is being published granting to F. H. Libbey and associates the right to establish a plant in Oshkosh for furnishing light, power and heat by means of electricity. The franchise is to be in force for 25 years from July 1.

Terre Haute, Ind.—The old electric light plant has been sold by Receiver Walsh to A. J. Crawford for \$40,000, he being the only bidder.

STREET RAILWAYS.

Albany, N. Y.—An application has been filed with the State Railroad Commissioners for authority to build an electric road in Cheektowaga and to the town of Java in Wyoming county. The application is made by the Buffalo Valley Railroad, but it is believed to be merely an extension of the Buffalo Traction Company's lines. The Commission will give a hearing on the application on the 13th inst.

Baton Rouge, La.—The car shed of the Home Electric Company was burned down on the 24th ult., resulting in the destruction of several cars, the office furniture and the repair shop. The loss is estimated at \$15,000, with only \$2,000 insurance.

Cleveland, O.—The Cleveland & Eastern Railroad Company has begun its line to Burton, 28 miles distant, and expect to complete it this year. Later the road will be extended to the Pennsylvania State line. The officers and directors of the company as organized are: President, H. P. McIntosh; vice-president, H. A. Sher-

win; secretary and treasurer, E. G. Tillotson; directors: H. P. McIntosh, H. A. Sherwin, E. A. Hartman, H. Clark Ford, W. H. Lamprecht, Howard White, W. N. Gates and E. G. Tillotson.

Fernandina, Fla.—J. E. Starke, of Jacksonville, has submitted a proposition to the city council, looking toward the building of an electric street car line to Amelia Beach, a local resort. The matter was submitted to a special committee of the council.

Kansas City, Mo.—A number of local capitalists are about to incorporate as the Kansas City Electrical Street Railway Company and will build and operate a line on the south side of the city.

Lawrence, Mass.—The substitution of an electric traction service for steam at the Arlington mill here has given great satisfaction as a measure of economy in the shifting of loaded and empty cars on the tracks connected with the establishment.

Mamaroneck, N. Y.—The Tarrytown, White Plains & Mamaroneck Railroad, the first line to connect Long Island Sound with the Hudson River, is completed, and the first car was run by electricity over the new branch from White Plains to Mamaroneck on Thursday evening. The route is about eighteen miles long, and includes a short branch to the Bloomingdale Asylum. The company has the right to charge 20 cents fare over its entire line, or 10 cents between White Plains and Mamaroneck.

Milwaukee, Wis.—The Milwaukee Street Railway Company's line to Waukesha and Waukesha Beach is completed and in operation.

Milford, Conn.—The Milford Street Railway Company's line between Milford and Woodmont has been opened for traffic. This gives a continuous trolley line between New Haven and Stamford, a distance of over fifty miles.

Pine Bluff, Ark.—The promoters of the electric street railway have secured a site for a power house and will erect the necessary buildings at once. Work on the road will begin as soon as the rails which have been ordered arrive.

Saginaw, Mich.—An ordinance of council is published in the "News" granting a 25-year franchise for a street railway in this city to C. Sidney Shepard, S. D. Loring, and Charles Eddy, who are allowed one month from June 20 to reject or accept it.

St. Paul, Minn.—The North St. Paul, White Bear & Suburban Railway has passed into the hands of the St. Paul City Railway Company and is now being operated by that corporation.

Staten Island, N. Y.—The Staten Island Midland Railroad, which controls about one-half of the electric railroads on Staten Island and has almost exclusive control of the streets on the south shore toward the interior, has abolished the system of transfers provided for in its franchise, and hereafter every one wishing to change from one branch of the road to another must pay a second full fare.

Waterville, Me.—A company has been organized to build and equip an electric road from Fairfield to Benton Falls. The members of the company are John T. Richards, Chas. D. Brown, Elisha Morgan, Edwin W. Heath and H. M. Mansfield. The primary object of the road is to carry freight between the two points.

West Bay City, Mich.—The Interurban electric road has settled with D. F. Campbell, of Bay City, for \$10,000 in payment for the lives of his wife and three children who were killed in the bridge accident on the road July 7, 1897.

MANUFACTURING, ETC.

Berlin, Ger.—A company has been formed here under the title of the Electric Power Company of Santiago de Chili, with a capital of 24,000,000 marks, of which Werner, Beit & Co., of Berlin, take as much as 12,000,000 marks, while the balance is taken in equal proportion by the Societe Generale d'Electricite. Part of the capital will be offered for subscription in England. Extensive electrical undertakings in Chili are soon to be started by the company.

Cleveland, O.—A meeting of the representatives of the suburban electric roads entering this city was held here on the 29th ult. for the purpose of arranging plans for a new express company to be operated by those lines. An organization for this purpose will probably be the result.

Detroit, Mich.—The Fire Commission has awarded the contracts for the new fire and police telephone system. The contract for cable was given to the Standard Underground Cable Company and for telephone apparatus to the Holzer-Cabot Electric Company of Brookline, Mass.

TRANSMISSION PLANTS.

Johnstown, N. Y.—The Cayadutta Electric Generating Company, composed of Supervisor A. Z. Wemple and Dr. W. H. Post of Fultonville and J. S. Wilson of Fonda, has purchased the dam and water privileges, known as the Clapper dam, on Cayadutta creek, near Sammonsville, and will use the water power to operate an electric plant. The company intends to put in a 100 horse power generator that will have a capacity of furnishing 800 incandescent and 50 arc lights, a sufficient number to furnish Fonda and Fultonville with all the light they are likely to need for some time.

Los Angeles, Cal.—The San Gabriel Electric Company's line has been completed and the works are in operation, furnishing power to customers at a distance of 23 miles from its source, the San Gabriel Canyon. The company has at its command 4,300 horse-power.

Lowville, N. Y.—Lafayette Wetmore of Martinaburgh has bought a water power at Belfort, and intends to harness the power and convey electricity to Lowville for lighting and manufacturing purposes. Belfort is fourteen miles northeast of Lowville, and the power in question, which is on Beaver river, it is estimated will develop about 2,000 horse-power.

Massena Springs, N. Y.—A contract has been placed by the St. Lawrence Power Company for the excavation of its canal. The generating plant which it is proposed to erect will entail an expense of about \$3,000,000. The water power available is some 200,000 HP. and the electric generator equipment will in time be 150,000 HP. The power will be electrically transmitted to several towns and cities.

COMPANY MATTERS.

Newark, N. J.—A mortgage for \$200,000 was recorded in the office of the Register of Essex County on the 1st inst. It was given by the Crocker-Wheeler Electric Company of East Orange to the Knickerbocker Trust Company of New York.

PERSONAL AND MISCELLANEA.

James Smith of Orange, N. J., has been appointed manager of the Elizabeth branch of the North Jersey Street Railway Company, to take the place of George F. Chapman, promoted to be general superintendent.

A few nights ago, at Northboro, Mass., Superintendent B. L. Dickinson of the Worcester & Marlboro Street Railway was aroused from his peaceful slumbers and presented with a handsome gold Waltham watch, gold chain and charm by the employees of the company, as a token of their esteem.

We are advised from Washington that Mr. Frederick Emory's term as Director of the Bureau of American Republics has been extended to October 1 of the present year. Mr. Emory will, as heretofore, by direction of the Secretary of State, continue to serve as Chief of the Bureau of Foreign Commerce, Department of State, in the work of editing the commercial reports of the diplomatic and consular officers. He was designated as Acting Director of the Bureau of the American Republics upon the death of the late Director, Mr. Joseph P. Smith, on the 5th of February last, and was made

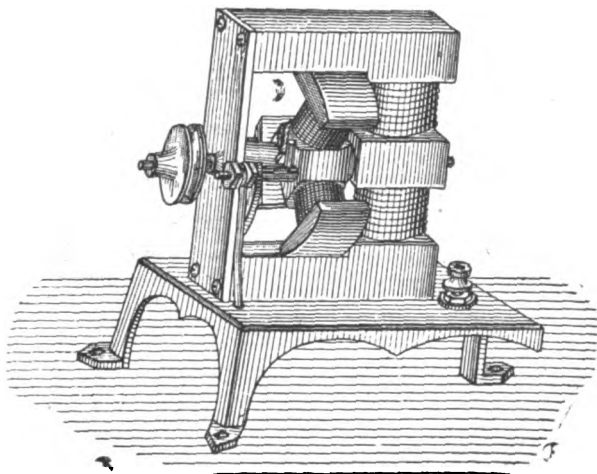
was the manager of the Franklin Institute. In 1887 he was engineer of the Edison Electric Light Company. In 1889 he was made chief engineer of the Edison General Electric Lighting Company, and in 1891 he was made president of the same company. In 1896 he was president of the American Electrical Exhibition Company. He is now the director of the Philadelphia Electrical Exhibition, which has proven so interesting both as an exhibition and a means of instruction to thousands of our public. Prof. Marks is strong in the belief that the usefulness of horses for business and pleasure purposes in large cities and towns is rapidly coming to an end, because electricity will do the work of the equines far better, cheaper, more cleanly and more healthfully than they do it. The General Electric Automobile Company is to be congratulated in having a servant of his prominence and energy at its head."

Walter K. Freeman, convicted in the New York Court of General Sessions of assaulting a young girl, has been released from prison after having served three years of his ten years' sentence. He was discharged because of a stipulation made by the District Attorney that he would press the complaint no further if the Court of Appeals sustained the decision of the Supreme Court directing a new trial. The Court of Appeals having done this, the prisoner on Wednesday last was declared a free man.

Lion tamers nowadays frequently use electricity in taming their beasts. When a wild lion or tiger is to be tamed, electric wires are first rigged up in the cage between the tamer and the animal. After a time the tamer turns his back, and the lion invariably makes a leap at him, but, encountering the charged wires, receives a paralyzing shock sufficient to terrorize it forever.

COMMERCIAL PARAGRAPHS.

The motor herewith illustrated, and known as No. 1 Motor, and which operates a 4½-inch fan by means of a battery, was invented by Mr. James H. Mason, 151 East 23d street, New York. Mr. Mason, who is a well-known inventor, manufactures various designs of portable fan outfits under patents owned by himself. In every case special care has been given to the design, which is scientifically correct, and in every case the construction is perfect. Mr. Mason is prepared to furnish portable battery fan outfits with fans 4½ or 8 inches in diameter, ranging in price from \$2.50 to \$10. For country residences or isolated dwellings



No. 1 Motor—Cut one-half height.

Director, with special powers, by action of the Executive Committee on the 28th of February last to serve until June 30, 1893.

Superintendent Robert H. Dalzell of the Bullock Electrical Company, Cincinnati, tendered his resignation a few days ago because of some disagreement between him and Vice President Neave. After doing so he went to his lodging rooms and took morphine to steady his nerves, but, it is supposed, drank an overdose. He was found shortly after lying unconscious upon his bed by an attendant who called in medical aid. After working with his patient for several hours the doctor pronounced him out of danger.

Prof. William D. Marks, who has just been elected president of the new General Electric Automobile Company, is, says the Philadelphia "North American," not only one of the most expert electricians in the country, but is also a scholar of great attainments in other branches of science. Prof. Marks, like most of the great electricians of the world, is American born, bred and reared. He came before the public prominently in 1876, when he was made Professor of Dynamical Engineering of the University of Pennsylvania. In 1878 he took up the study of electricity in accordance with the suggestion of his intimate friend, Thomas A. Edison, and it has ever since been with him not only a source of profit, but also a labor of love. He is to-day recognized as one of the greatest of authorities in all that pertains to electrical matters. Prof. Marks is a man of great executive ability, and has held many positions of trust and responsibility in this city, which for over twenty years has been his home. In 1884 he

where no steady supply of electricity can be obtained from city mains for operating a fan during the summer months, the portable fan outfit sold by Mr. Mason would seem to be just what is needed, as the first cost is extremely low and the cost of operation but one cent an hour. The fact that Mr. Mason has received many orders for fans of this description, one order alone being for 500, would certainly go to prove that an outfit of this description, where no acids are obliged to be handled, is just what is needed during the hot season and is easily within the reach of all.

The Holophane Glass Company of No. 1 Broadway, New York, is manufacturing a line of glass globes that far surpasses any make of globes now on the market. The Holophane compound prism glass places all high-power sources of light such as the electric arc, incandescent gas, incandescent electric and acetylene under absolute control, enabling the light to be so distributed and diffused as to give the highest possible illuminating efficiency in each particular case. The methods by which the Holophane glass is produced make it absolutely different from any other form of corrugated or ribbed glass in existence. Its general appearance when not illuminated does not differ materially from the ordinary ribbed and prism glass now on the market; there is one infallible method however by which Holophane glass can be instantly recognized, namely, that when put over a light the whole surface shines. The value of a globe, as is well known, can only be determined by getting underneath so as to look up at it. With

the ordinary globes most of the downward rays are cut off, whereas in the case of a Holophane there is an increased brilliancy. This well known concern has recently gotten out an exceedingly attractive and fully illustrated pamphlet of some 60 pages descriptive of the Holophane which should certainly be in the hands of all those interested in securing good illumination.

RECENT COMPANY ELECTIONS.

Providence & Taunton Street Railway Company, Taunton, Mass.—President, Col. J. J. Whipple of Brockton; treasurer, P. L. Walton of Taunton; clerk, George A. Rutman of Taunton; directors: W. A. Tucker and E. P. Shaw, Jr., of Taunton, F. K. Peck of Providence, A. B. Williams of Taunton, and the officers.

Penn Electric Light Company, Philadelphia.—Directors: A. J. DeCamp, Henry Olay, Samuel R. Huey, James McManis, W. L. Elkins, Martin Maloney, George S. Graham, David H. Lane and James E. Hays.

General Electric Automobile Company, Philadelphia.—President, William D. Marks, formerly president of the Edison Electric Light Company; directors: W. W. Foukard, president of the Trades League and senior member of the firm of Hood, Foukard & Co.; O. C. Hobby-hell, treasurer of the Fidelity Mutual Life Assurance Company; H. S. Hale, president of Hale & Kilburn Manufacturing Company; E. F. Morse, president of Morse, Williams & Co. Elevator Works; J. H. Lorimer, president of W. H. Lorimer Sons Co.; F. R. Maturin, Secretary of Corporation Trust Company of New Jersey; R. M. Hunter, electrician and inventor. The Fidelity Insurance, Trust & Safe Deposit Company of Philadelphia are the subscription and financial agents.

Deering Electric Light Company, Deering, Me.—President, W. W. Mitchell; treasurer and manager, George W. Brown; directors: W. W. Mitchell, D. W. Hoegg, Myron E. Moore, Frank W. Stockman, J. L. Watson, George W. Brown, Joseph B. Walton, Caleb E. Marsh.

INCORPORATIONS.

The People's Electric Light, Heat & Power Company, Nanticoke, Pa. Capital stock, \$71,000. Incorporators: M. W. Morris, Pittston; C. E. Stegman, J. A. Bullard, Sol. Hirsch, S. Wormser, E. W. Mulligan, W. G. Weaver and J. W. Morris, of Wilkes-Barre, Pa.

The Toledo Heating & Lighting Company, Toledo, O.—to furnish electricity for lighting, heating and power and hot water and steam for heating and power purposes. Capital stock, \$125,000. Incorporators: H. L. Yanger, H. E. Marvin, Irving R. Hiett, T. W. Oulids, R. R. Lee and George H. Beckwith.

The International Electric Company, Cleveland, O.—to manufacture and deal in electrical appliances. Capital stock, \$10,000. Incorporators: A. W. Mayers, E. H. Shaw, W. R. Studebaker, W. S. Hale and Charles Seaton.

The St. Louis & Belleville Electric Railway Company of East St. Louis has certified to an increase of capital from \$50,000 to \$350,000.

The Ottumwa Electric & Steam Company, Ottumwa, Ia.—to operate street railways in the city of Ottumwa and vicinity. Capital stock, \$200,000. Incorporators: Samuel Mahon, Calvin Manman, J. W. Garues, J. B. Sax, William Doggett and J. H. Merrill.

The Mutual Electric Company, Chicago, Ill. Capital stock \$25,000. Incorporators: E. H. Oheuey, F. S. Richmond and H. O. Hall.

The Portchester Electric Lighting Company, Portchester, N. Y.—to manufacture electricity and use it for producing light, heat and power. Capital stock, \$50,000. Directors: William L. Ward and Addison Johnson, of Portchester, and William E. Ward of Itey.

The North Jersey Light and Power Company, Montclair, N. J.—to distribute electricity for power and light purposes. Capital stock, \$15,000, of which \$1,000 is paid in. Incorporators: William T. Francisco, Albert C. Williams and Harry M. Warren, all of Montclair.

The Ephrata Electric Company, Ephrata, Pa. Capital stock, \$15,000. Directors: F. E. Halcy, Philadelphia; A. W. Mentzer (treasurer), H. G. Mentzer and John W. Von Nerda, Ephrata; S. N. Bailey, Dillsburg, Pa.

The Gross Electric Experimental Company, Gillespie, Ill. Capital stock, \$12,500. Incorporators: William M. Gross, John Sellers, William M. Williams.

The Eagle Electric Works, Peoria, Ill., has increased its capital stock from \$5,000 to \$15,000.

The Mingo Light Company, Mingo Junction, O.—to maintain an electric light plant in Mingo Junction. Capital stock, \$1,000. Incorporators: Benjamin L. Hirschfeld, Joseph May, William May, Louis W. May and Thomas M. Loup.

The Lima Honyoe Electric Light Company of Honyoe Falls, N. Y. Capital stock, \$25,000. Directors: H. H. Sittel, R. L. Freyer, J. C. Conway, P. P. Miller, H. W. Bux, A. L. Williams, A. M. Huldin, H. C. Gilbert and Clarence McGregor, Buffalo.

The Standard Electric Vapor Motor Company, New York. Capital stock, \$50,000. Directors: S. W. Warner, B. L. Warner and W. M. Warner, of Yonkers.

The Manhattan Institute of Electro-Therapeutics, New York. Capital stock, \$25,000. Directors: Henry H. Goldberg and Ralph Goldberg, New York, and F. M. Buckley, Brooklyn, N. Y.

The General Electric Company owed on July 1, 1893, \$1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

A SPECIAL PRIZE OFFER.

TELEPHONE AND TELEGRAPH.

Theses Competition for Students.

We take pleasure in announcing to the students who are taking the electrical engineering course in the various Universities of this country that we have decided to award prizes for the most meritorious theses sent us by students graduating this year, as follows: First prize, \$25; second prize, \$15; the next three best theses to receive honorable mention with a year's paid subscription to *ELECTRICITY*.

The conditions of the competition will be as follows: Competing theses shall be sent in anonymously indorsed on the outside "For *ELECTRICITY*'s Thesis Competition." Each thesis should be either accompanied or followed by a sealed envelope containing the anonymous or assumed name under which the thesis was sent in as well as the correct name and address of the author and the name of the University or College he represents. These envelopes will not be opened until all the theses submitted have been carefully examined and those deserving of prizes selected. Each of these envelopes should also contain a note from the Professor of Electrical Engineering of whatever University the student is attending, stating that the candidate is eligible to enter the competition.

The merit of the various theses submitted will be judged by the editorial staff of *ELECTRICITY*, assisted by any outside experts it may be deemed advisable to call in.

The theses will be graded according to their apparent permanent value for the advancement of practice or theory in electrical engineering. No thesis which has previously been published in full or in substance will be eligible for the competition, and whenever in a thesis it is found necessary to quote an authority credit must be given.

The two theses awarded first and second prizes will appear in the columns of *ELECTRICITY* duly credited to their respective authors, as also those receiving honorable mention. The right is reserved to reject all these submitted in case none is found worthy of a prize.

All theses awarded either a prize or honorable mention are to become the property of *ELECTRICITY*, although all drawings will be immediately returned after publication as well as those theses receiving neither prize nor honorable mention.

We make this announcement at the present time so as to give the students who desire to enter this competition ample time to prepare creditable papers. No definite time is specified as to when all papers should be in, but if possible we would like to have them all on hand by August 1.

If the conditions of the competition as set forth above are not perfectly clear, we will be pleased to answer any inquiries relating to this matter.

The General Electric Company owed on July 1, 1898, \$1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

The Independent Telephone Convention.

The Independent Telephone Association held its second annual meeting at Chicago on June 30, July 1 and 2. The attendance was quite large and the proceedings were conducted with a view to practical results in the contest which the independent companies are waging against the strongly entrenched Bell monopoly. The sessions of the Association are for very good reasons held with closed doors, and our information in regard to the transactions is limited to the fact that it was determined that the fight against the Bell Company is to be kept up and extended into fields not heretofore entered by the independent companies.

Several months ago, as we learn from the Burlington *Hankey*, the citizens residing in Massena and Cumberland, in the southern part of Cass county, Iowa, were quite anxious to have telephone communication with Atlantic, the court town, and to this end negotiated with the Iowa Union Telephone Company (Bell) for some time to have them extend their line in that direction. Quite a sum of money was pledged by subscription, and after waiting for some months the citizens took hold of the matter and established a line of their own, which has been in operation for about sixty days. Since then the Iowa Company announced their intention of building a line, and had commenced setting poles to Massena, but when they attempted to erect poles in the city limits they were informed that the city council would not permit them. As the matter stands now, the Iowa Company has decidedly the worst of it, having set twenty-four miles of poles and being able only to get into Cumberland, and it is said they will have trouble there in a short time.

A few days ago an extraordinary long circuit was made up over the Postal Telegraph system from Little Rock, Ark., to Vancouver, British Columbia, the total distance being 5,000 miles. This stretch of wire went by way of Birmingham, Ala., and had automatic repeaters at the following points: Richmond, Va., New York City, Montreal, Fort Williams, Ontario, Swift Current, Northwest Territory, thence to the Pacific coast. Mr. T. L. Gouldings, chief of Vancouver, exchanged greetings with a number of Little Rock citizens who were present by invitation of the local manager.

Western Union officials say the tax on telegraph messages of one cent will be levied on all messages. The senders must pay for the stamps, affix them to the messages and cancel the same with their names and the date of cancellation. The company, having no facilities for handling stamps, will only carry a limited supply, during the early period of the enforcement of the law, for the accommodation of its patrons.

The new telephone company at Indianapolis has filed with the board of works two bonds—one for \$10,000 and the other for \$25,000. The former is to guarantee the city against any damage from the operation or construction of the plant and the latter to insure faithful performance of the contract. Both bonds were required by the contract between the city and company. The American Surety Company is surety on both bonds.

At Lincoln, Neb., a few days ago the Supreme Court handed down an opinion in which the action brought by John O. Yeiser of Omaha to compel the Nebraska Telephone Company to put an instrument in his office at the monthly rental of \$2.50 was dismissed, and the authority of the court to grant the relief on the proceeding denied. The court holds that fixing of telephone rates is a matter for the Legislature and not for the courts.

The sub-committee of the Philadelphia councils' electrical committee have agreed to report the Drawbaugh Telephone bill with a favorable recommendation. The bill is practically the same as the one introduced by the company in 1897, which was so amended that it was not accepted by the company. It provides for a maximum charge of \$75 per annum for business houses, \$50 for private houses, and the payment to the city of 3 per cent. of the gross receipts; also the filing of a bond of \$50,000 for faithful compliance with the ordinance.

The New York Telephone Company has officially announced that the charge for a telephone message from any pay station in the Borough of Manhattan to any other telephone station connected with an exchange of the company in the same borough will be 10 cents instead of 15 cents as heretofore; a reduction of five cents has also been made on messages from any of its stations in the Borough of Manhattan to its stations in the Borough of the Bronx, the charge heretofore being 25 cents.

The annual meeting of the directors of the Telephone Manufacturing Company of Sumter, S. C., was held at the office of the company in Sumter a few days ago, with all of the directors, both resident and from other places,

present. The report of the manager showed that the year's business was very satisfactory indeed and was sufficiently encouraging to warrant the immediate enlargement of the factory so that the output will be more than doubled.

Stanley F. Stout counsel of the Western Telephone Construction Company, died at Chicago on the 18th ult. In his will he directed that his body be cremated and his ashes be thrown into the lake. For five years he had devoted almost his entire time to the patent interests of the Western Telephone Construction Company, not losing a single case entrusted to him.

The People's Telephone Company, better known as the Havens Company, has been granted a franchise in Terre Haute, Ind., by the city council. The Bell company people made strenuous efforts to prevent the new company from getting a franchise and kept up the fight for two or three years.

The Boston *News-Bureau* states that the New England Telephone & Telegraph Company announces that the new 1 cent stamp tax on telephone messages for which a charge of 15 cents or more is charged will be paid by the company without additional cost to subscriber.

The Citizens' Telephone Company has succeeded in getting a franchise in Medina, N. Y., and will build an exchange, 75 subscribers having been obtained. The local Bell company is endeavoring to head off the new company and has lowered its rates.

The Southern New England Telephone Company at New Haven, Conn., announces that it will change its rates for night service from 10 cents to 25 cents, the income from the extra charge to be devoted to the payment of the war tax. As a compensation, the time will be doubled.

A stock company is being organized by several prominent citizens of Fredericksburg, Va., for the establishment of a telephone line between Fredericksburg and Spotsylvania Courthouse. About one-half of the stock has been already subscribed and the remainder is in sight.

The People's Telephone Company has secured a franchise for Windsor, Sandwich and Walkerville, Can., for 20 years. Its rates will be \$21 for business places and \$8 for residences and with Detroit connections \$35 and \$22. The company will pay the city \$225 a year.

The authorities of New Rochelle, N. Y., have contracted with the New York Telephone Company for a police system of telephones, to be put in operation as soon as possible. Eleven instruments will be used, with a switchboard in police headquarters.

There has lately been a good deal of friction between the Lexington, Ky., council, and the East Tennessee Telephone Company, and the council is now in the mood to grant an acceptable franchise to a responsible independent company.

Superintendent Baker of the Southwestern Telegraph & Telephone Company at Austin, Tex., announces that the war taxes on telephone messages will be paid by the company itself and not collected from persons using its lines.

An ordinance has been introduced in the borough council of Homestead, Pa., granting a franchise to an independent company recently organized. The new company promises telephone service at \$12 a year.

The new State Telephone Company has been granted a franchise in Jackson, Mich. The company will at once commence to erect what it says will be one of the finest 1,000 instrument exchanges in existence.

The West Point Telephone Company has opened its exchange at West Point, Neb., for business. It has 51 instruments installed in the business houses and offices of the city.

The Des Moines, Ia., Mutual Telephone Company has put in an application for the telephone service of the State House. The Bell 'phones are still used in the building.

The New York & New Jersey Telephone Company has applied to the trustees of South Orange for permission to erect a plant in that village.

The Gordon Telephone Company has been granted a franchise for the establishment of a telephone system in Charlestown, W. Va.

New Companies Incorporated.

The Beverly & Marlinton Telephone Company, Hutonsville, W. Va. Capital stock, \$5,000. Incorporators: Perry Bosworth, J. L. Bosworth, A. B. Bosworth, T. O. Russell and O. A. Barlow.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by **ELECTRICITY** from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crk indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apr. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.						Authoriz'd	Issued.			
Albany, N. Y.—July 5:							Hartford Conn.—July 5:						
Albany Ry. Co.	100	2,000,000	\$1,750,000	1 1/2 % Q., Feb. '98.	148	145	Hartford Street Ry. Co.	100	\$4,000,000	\$200,000	8 % S., Jan., '98.	140	--
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, '97.	65	6 1/2	Hartford & West Hartford RR.	100	1,000,000	247,000	.....	--	--
Traction Co. (Saratoga)	100	50,000	50,000	.....	--	--	Holyoke Mass.—July 5:						
Allentown, Pa.—July 5:							Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	200	235
Allentown & Lehigh Val. Trac. Co.	100	4,000,000	1,500,000	.....	--	15	Hoboken, N. J.—July 5:						
Bridgeport, Conn.—July 5:							North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	--
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	45	60	Indianapolis, Ind.—July 5						
Baltimore, Md.—July 5:							**Citizens' Passenger Ry.	100	5,000,000	5,000,000	.....	28 1/2	80
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	72	73	Lancaster, Pa.—July 5:						
Baltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	28 1/2	23 1/2	Pennsylvania Traction Co.	100	10,000,000	9,900,000	.....	--	--
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82 1/2	Lancaster & Col. Electric Ry.	100	10,000,000	9,900,000	.....	--	--
Boston, Mass.—July 5:							West End Street Railway	100	10,000,000	9,900,000	.....	--	--
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	--	--	Louisville, Ky.—July 5:						
North Shore Traction Co.	100	4,000,000	4,000,000	.....	10	15	Louisville Ry.	100	4,000,000	8,500,000	1 1/2 % Q., Oct., '97.	84	39
North Shore Traction Co.	100	2,000,000	2,000,000	6 % S., A. & O.	72	76	Louisville Ry.	100	2,500,000	2,500,000	2 1/2 % S., Oct. 1, '97.	96	100
West End Street Ry. Co.	50	10,000,000	9,045,000	1 % S., Oct., '97.	8 1/2	85 1/2	Minneapolis, Minn.—July 5:						
West End Street Ry. Co.	50	4,000,000	6,400,000	4 % S., Oct. 1, '97.	103 1/2	104	Twin City Rapid Transit	100	17,000,000	15,010,000	.....	14	20
Boston Elevated R. R.	100	10,000,000	6,400,000	.....	67	67 1/2	Twin City Rapid Transit	100	8,000,000	1,714,300	1 1/2 % Jan., '98.	--	100
Brooklyn N. Y.—July 5:							Montreal, Canada.—July 5:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	201	--	Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	257	257 1/2
Brooklyn Rap. Transit Co., tr. cert.	100	20,000,000	20,000,000	.....	51 1/2	51 1/2	Toronto Street Ry. Co.	100	6,000,000	6,000,000	1 1/2 % S., J. & J.	98	96 1/2
Brooklyn Heights Railroad	100	200,000	200,000	.....	212	213	Memphis, Tenn.—July 5:						
Brooklyn City RR.	100	12,000,000	12,000,000	2 1/2 % Q., Jan., '98.	201	205	Memphis Street Railway Co.	100	500,000	500,000	.....	15	--
Brooklyn, Queens Co. & Sub. RR.	100	2,000,000	2,000,000	.....	47	48	New Haven, Conn.—July 5:						
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1 1/2 % Oct. 1, '97.	201	205	Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	60	--
Kings County Elevated	100	4,750,000	4,750,000	.....	87	--	New Haven Street Railway Co.	100	1,250,000	1,000,000	2 1/2 % A., July '98.	60	80
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	87	--	New Haven & Centerville	100	700,000	800,000	.....	--	--
Nassau Electric Railroad	50	6,000,000	6,000,000	.....	74	80	Winchester Avenue RR.	25	1,000,000	600,000	.....	40	42
Atlantic Avenue Railroad	50	2,000,000	2,000,000	.....	--	--	New Orleans, La.—July 2:						
Brooklyn, B. & W. E. Railroad	100	1,000,000	1,000,000	.....	--	--	Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	140	160
Buffalo, N. Y.—July 5:							New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1 1/2 % Q., Jan., '98.	123 1/2	124
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	.....	58	60	New Orleans Traction Co.	100	5,000,000	5,000,000	.....	1	3
Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q., Dec., '97.	80	82	New Orleans Traction Co.	100	2,500,000	2,500,000	.....	7	10
Columbus O.—July 5:							New Orleans Traction Co.	100	2,000,000	2,000,000	8 % S., Jan., '98.	81	88
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	49	50	New Or. City & Lake RR.	100	2,000,000	2,000,000	4 % S., Jan., '98.	16	17
Columbus Central Street Railroad	100	1,500,000	1,500,000	.....	--	--	Orleans Railroad	50	500,000	185,000	1 1/2 % June, '94.	68 1/2	54 1/2
Charleston, S. C.—July 5:							St. Charles Street Railway	50	1,000,000	1,000,000	1 1/2 % Jan., '98.	--	--
Charleston City Ry. Co.	50	100,000	100,000	8 % S., Jan., '97.	--	--	New York—July 5:						
Enterprise City RR. Co.	25	1,000,000	250,000	.....	--	--	Central Crostown RR.	100	600,000	600,000	2 1/2 % Q., July, '97.	240	--
Chicago, Ill.—July 5:							Christopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	160
Chicago City Ry. Co.	100	12,000,000	12,000,000	8 % Q., Dec. 31, '97.	264	265	Dry Dock, E. B. & W. & Battery RR.	100	1,200,000	1,200,000	1 1/2 % Q., Feb., '98.	175	195
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	.....	127 1/2	131 1/2	Metropolitan Street Ry. Co.	100	80,000,000	80,000,000	1 1/2 % Q., Jan., '98.	159	159 1/2
Lake Street Elevated RR.	100	10,000,000	10,000,000	.....	--	8	Bleecker St. & Fulton Ry. guar.	100	900,000	900,000	3 % A., July, '97.	32	88 1/2
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	.....	--	--	Broadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2 1/2 % Q., Oct., '97.	110	220
Met. West Side Rl. const. stk.	100	15,000,000	2,500,000	.....	--	--	Gen. Park, N. & E. Rivers RR. guar.	100	1,800,000	1,800,000	2 1/2 % Q., Jan., '98.	180	186
North Chicago Street RR.	100	10,000,000	6,600,000	8 % Q., Jan., '98.	213	214	Eighth Avenue RR.	100	1,000,000	1,000,000	.....	385	390
North Chicago City RR.	100	500,000	249,900	.....	--	--	42d St. & Grand St. Ferry RR. guar.	100	750,000	748,000	4 1/2 % Q., Feb., '98.	330	360
South Chicago City Railway	100	2,000,000	1,604,200	.....	--	--	Ninth Avenue RR.	100	800,000	800,000	.....	170	180
West Chicago St. RR. Co.	100	20,000,000	18,189,000	1 1/2 % Q., Feb., '98.	92 1/2	93	Sixth Avenue RR.	100	2,000,000	2,000,000	.....	200	210
Chicago West Div. Ry. guar.	100	1,250,000	624,900	35 %	--	--	Twenty-third St. R. R. Co. guar.	100	600,000	600,000	4 1/2 % Q., Feb., '98.	325	--
Chicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.	--	--	Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	172 1/2	--
Cincinnati, Ohio.—July 5:							Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	178
Cincinnati Inc. Plane Ry.	50	1,000,000	575,000	.....	--	20	42d St. Manhattan & St. Nich. Av	100	2,500,000	2,500,000	.....	60	65
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2 1/2 % Q., Feb., '98.	--	75	Union (Hudson) Ry.	100	2,000,000	2,000,000	.....	175	200
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000	.....	23	25	Newark N. J.—July 5:						
Cincinnati Street Ry. Co.	50	18,000,000	14,000,000	1 1/2 % Q., Jan., '98.	112 1/2	113	Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	.....	49 1/2	50
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1 1/2 % Q., Jan., '98.	--	--	Newark Passenger Ry.	100	6,000,000	6,000,000	.....	180	190
Cleveland, Ohio.—July 5:							Rapid Transit Street Ry.	100	504,000	504,000	11 1/2 % A.	--	--
Aaron, Bed. & Elev. Elec. Ry.	100	1,000,000	1,000,000	3 % Jan., '98.	39	40	Pittsburg, Pa.—July 5:						
Cleveland City Ry.	100	8,000,000	7,600,000	3 % Q., Oct., '97.	55	60	Allegheny Traction Co.	50	500,000	500,000	.....	45	--
Cleveland Electric Ry.	100	12,000,000	12,000,000	3 % Q., Oct., '97.	50	53	Consolidated Traction Co.	50	15,000,000	15,000,000	2 % Jan., '96.	11 1/2	14 1/2
Detroit, Mich.—July 5:							Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	8 % May, '97.	48 1/2	49
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	.....	100 1/2	--	Central Traction Co.	50	1,500,000	1,500,000	.....	--	--
Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '98.	175	--	Citizens' Traction Co.	50	8,000,000	8,000,000	6 % A.	--	--
Rapid Railway Co.	100	250,000	250,000	.....	--	100	Duquesne Traction Co.	50	8,000,000	8,000,000	6 % A.	--	--
Detroit Electric Railway	100	1,000,000	1,000,000	.....	--	--	Pittsburg Traction Co.	50	2,500,000	1,900,000	8 % Aug., '96.	--	--
Wyandotte & Detroit River Ry.	100	250,000	200,000	.....	100	110	Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2 1/2 % Jan., '98.	--	--
Dayton O.—July 5:							Pgh., Allegheny & Man. Trac. Co.	25	8,000,000	12,994,889	2 % Aug., '96.	--	--
City Railway Co.	100	1,500,000	1,470,600	1 1/2 % Q., Jan. 1, '98.	100	102	Pittsburg & West End Ry.	25	8,000,000	8,000,000	5 % Jan., '96.	--	19
City Railway Co. pfd.	100	600,000	600,000	1 1/2 % Q., Jan. 1, '98.	140	145	Second Avenue Traction Co.	50	4,000,000	1,800,000	5 % A., June 30, '97.	--	--
People's Street Railway	100	1,100,000	1,100,000	.....	100	--	Suburban Rapid Transit Co.	50	800,000	200,000	.....	--	--

* Unlisted. † Ex div.
 a Consolidation of Baltimore Traction Company and City & Suburban Railway Company.
 Company consists of: Baltimore Traction Company, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Pothan Railway, Pimlico & Pikeville Railway and Wallbrook, Gwynn Oak & Pothan Railway and Park.
 b Leased to Boston Elevated Railroad Company.
 c Owned by Brooklyn Rapid Transit Company.
 d Leased to Brooklyn Heights Railroad Co., which guarantees 10 % on capital stock.
 e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
 f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR.
 g Owned by Atlantic Ave. RR. and leased to Nassau Electric RR.
 h \$200 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.
 i \$200,000 of stock owned by North Chicago Street Railroad Company.
 j Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
 k \$25 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company.
 l Majority of stock owned by Chicago West Division Railway Company; 5 % on \$1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
 m Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

* Unlisted. † Full paid. ‡ Outstanding. † Ex div.
 a Leased to New Orleans Traction Company at 6 % on stock.
 b Leased to New Orleans Traction Company at 8 % on stock.
 c Leased to Central Crostown Railroad at 8 % on stock and interest on bonds.
 d Operating the former Met. Trac. system, that corporation having become extinct.
 e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

PASSENGER RAILWAYS.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.	NAME.	Par.	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authoriz'd	Issued.						Authoriz'd	Issued.			
New Bedford Mass.—July 5							Boston, Mass.—July 5:						
Union Street Railway Co.....	100	\$850,000	\$850,000	2%, Feb. '98.	...	158	American Bell Telephone Co.....	100	50,000,000	28,650,000	4% Q. Jan., '98.	274 1/2	275
Northampton, Mass.—July 5							Erie Telegraph & Telephone Co.....	100	.....	.....	1% Q. Jan. '98.	68	69
Northampton Street Ry.....	100	800,000	225,000	4% A., Jan., '98.	165	175	New England Telephone Co.....	100	10,894,600	10,804,600	\$1.50 Q., Feb. '98.	181	182
Omaha, Neb.—July 2:							New York.—July 5:						
Omaha Street Ry.....	100	5,000,000	5,000,000	.....	25	..	American Telegraph & Cable Co....	100	14,000,000	14,000,000	1% Q. Q.	...	95
Paterson, N. J.—July 5.							*Central & South Am. Tel. Co.....	100	6,500,000	6,500,000	5% Q. Q.	101	106
Paterson Ry. Co.....	100	1,250,000	1,250,000	.....	185	86	*Commercial Cable Co.....	100	10,000,000	10,000,000	1% Q. Q.	160	160
Providence, R. I.—July 5							Franklin Tel. Co.....	100	1,000,000	.....	1% Q. Q.	40	44
United Traction & Electric Co.....	100	8,000,000	8,000,000	3/4%, Jan. '98.	59 1/4	63	Erie Telegraph & Telephone Co.....	100	5,070,000	4,800,000	1% Q. Jan., '98.	88	89
Philadelphia.—July 5:							*Gold & Stock Tel. Co. guar. 6%	100	8,000,000	.....	1% Q. Q.	109 1/2	111
Fairmount Park Trans. Co...\$20 pd.	50	2,000,000	1,770,000	2%, Dec. '97.	14 1/2	..	*International Ocean Tel. Co. guar 6%	100	8,000,000	.....	1% Q. Q.	108	111
Hestonville, Man. & Fairmount....	50	1,966,100	11,966,100	2 1/2%, July 15, '97.	48 1/2	45	Mexican Telephone Co.....	100	2,000,000	.....	1% Q. Q.	57 1/2	70
Hestonville, Man. & Fairmount....	50	533,900	533,900	3% Jan. 10, '98.	65 1/2	66	*New York & New Jersey Tel. Co..	100	5,000,000	8,723,000	1 1/2% Q. Jan., '98.	147	149
Fairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	8% Feb. 1, '98.	65	66	*Pacific & Atlantic Tel. Co. guar. 4%	25	2,000,000	.....	2% Q. Q.	72	80
Union Traction Co.....\$12 1/2 pd.	50	30,000,000	29,930,450	.....	18	18 1/2	*Postal Telegraph Cable Co.....	100	15,000,000	15,000,000	1% Q. Q.	85	..
Electric Traction Co.....	50	.....	8,297,920	.....	71 1/2	71 1/2	*South & Atlantic Tel. Co. guar. 5%	25	950,000	559,525	2% Q. Q.	110	113
Old Citizens' Passenger Ry.....	50	500,000	192,500	\$3 share Q.	275	..	*Commercial Union Telegraph Co..	25	500,000	500,000	8% S., Jan. 1 '98.	110	113
Frankford & Southwark Pass. R.	50	.....	11,875,000	\$14 share A.—Apr. '97	39 1/2	..	Western Union Telegraph Co.....	..	97,870,000	.....	1 1/2% Jan., '98.	92 1/2	98
Lehigh Avenue Ry. Co.....	50	1,000,000	.....	.....	43	..	Miscellaneous.—July 5:						
Lombard & South Street Ry.....	25	.....	1,000,000	A. & O.	89	90 1/2	American Dist. Tel. (Phila.).....	25	400,000	.....	1% Q., Feb. '98.	14	..
Second & Third Streets Ry.....	50	1,000,000	771,076	\$9 share A., Mar. '97	256	..	Bell Teleph. Co. (of Canada).....	100	8,168,000	8,168,000	2% S.	170 1/2	178
People's Traction Co.....	50	10,000,000	16,000,000	3% A., April, '97.	..	..	Cheapeake & Potomac Tel. Co..	100	.....	.....	.....	59	..
Germanatown Passenger Ry.....	50	1,500,000	572,800	\$5.25 share—1898.	135	..	Chicago Telephone Co.....	100	.....	.....	.....	202	..
Green & Coates Passenger Ry.....	50	500,000	150,000	3% Jan., 1898.	138 1/2	..	Central Dist. Pk. & Tel. Co. (Pha.)	100	750,000	750,000	.....	70	76
People's Passenger Ry.....com.	25	1,500,000	174,000	.....	..	..	Empire & Bay States Telegraph Co.	..	.....	.....	.....	70	76
People's Passenger Ry.....pfd.	25	1,500,000	174,000	.....	..	..	Hudson River Telephone Co.....	100	2,000,000	2,000,000	1% Q. Q.	70	72
Philadelphia Traction Co.....	50	30,000,000	20,000,000	4% S.—Oct. 1, '97.	86 1/4	87	*Northwestern Telephone Co. guar.	50	2,500,000	2,500,000	2 1/2% Q. Q.	110	113
Philadelphia & Bainbridge St.....	50	.....	140,000	6% A.—Mar. '97.	142 1/2	..	Providence (R. I.) Teleph. Co.....	50	.....	.....	.....	87 1/2	..
Continental Pass. Ry. Co. guar.	50	1,000,000	580,000	\$6 share—July, '97.	142 1/2	..	Southern New Eng. Teleph. Co.....	100	8,000,000	.....	.....	120	122
Empire Passenger Ry. Co.....	50	600,000	600,000	.....	..	..				
Philadelphia City Pass. Ry.....	50	1,000,000	1475,000	\$7.50 share July '97	175	180							
Philadelphia & Gray's Fy. RR.....	50	1,000,000	298,650	\$3.50 share July '97	90 1/4	..							
Ridge Avenue Passenger Ry.....	50	750,000	1420,000	\$12 share, July '97	291	300							
Philadelphia & Darby Ry. guar.	50	.....	1200,000	\$2 share, July, '97.	..	..					
17th & 19th Sts. Pass. Ry. guar.	50	.....	1250,000	1 1/2% S., July, '97.	157 1/2	..							
Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	1335,000	\$11 sh. A., July, '97	24 1/4	..							
Union Passenger Ry. Co.....	50	1,500,000	1600,000	\$9.50 sh., July '97	23 1/2	..							
West Philadelphia Pass. Ry.....	50	750,000	1750,000	\$10 share, July '97	234	235							
Rochester, N. Y.—July 5:							Boston, Mass.—July 5.						
Rochester Railway Co.....	100	5,000,000	5,000,000	.....	10	14	Fort Wayne Electric Co.....	..	.....	.....	.....	..	..
Reading, Pa.—July 5:							Pt. Wayne Elec. Co. T. Sec. Series A.	25	.....	.....	.....	..	..
Reading Traction Co.....	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..	General Electric Co. (of Canada)...	100	40,000,000	30,460,000	2% Q., Aug., 1898.	89 1/2	40
City Passenger Ry.....	50	350,000	350,000	Jan., '98.	112	..	General Electric Co.....com.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	94	96
East Reading Electric Ry.....	50	1,000,000	1,000,000	Jan., '98.	64	..	T. H. Elec. Co. T. Secur. Series D.	..	.....	.....	.....	2 1/2	..
St. Louis Mo.—July 5							Westinghouse Elec. & Mfg. Co. com.	50	.....	146,700	.....	24	25
Fourth Street & Arsenal Ry.....	50	800,000	150,000	.....	..	..	Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,063	1 1/2% Q., Feb., '98.	54	55
Jefferson Avenue Ry. Co.....	50	400,000	400,000	2% Dec., 1898.	..	..	Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	.....	..	..
Lindell Ry.....	100	2,500,000	2,400,000	1 1/2% Jan., '98.	122 1/2	125	New York.—July 5:						
National Railway Co.....	..	2,500,000	2,479,000	1 1/2% Jan., '98.	..	..	Edison Elec. Ill'g Co., New York...	100	10,000,000	7,988,000	.....	181	185
Cass Avenue & Fair Grounds.....	..	2,500,000	2,500,000	.....	..	..	*Edison Elec. Ill'g Co., Brooklyn...	100	4,000,000	3,750,000	1 1/2% Oct., '97.	119 1/2	..
Citizens RR.....	100	2,000,000	1,500,000	4% Oct., '98.	90	110	Edison Ore Milling Co.....	100	.....	.....	.....	10	18
St. Louis RR.....	100	2,000,000	2,000,000	2 1/2% Jan., '98.	95	105	Edison Electric Storage Co.....	100	.....	.....	.....	21	25
Missouri RR.....	50	2,400,000	2,300,000	1 1/2% Jan., '98.	170	172 1/2	General Electric Co.....com.	100	40,000,000	30,460,000	2% Q., Aug., 1898.	89 1/2	40
People's RR Co.....	50	1,000,000	300,000	50c., Dec., '89.	..	..	General Electric Co.....pfd.	100	10,000,000	4,252,000	3 1/2% S., July, '98.	94	96
Southern Electric Ry.....com.	50	500,000	500,000	.....	57	60	Interior Conduit & Insulation Co..	100	1,000,000	1,000,000	.....	41	..
Southern Electric Ry.....6% pref.	100	1,000,000	1,000,000	1 1/2% Jan., '98.	108	110	United Elec. Lt. & Pow. Co.....pfd.	..	1,000,000	.....	.....	..	..
St. Louis & Suburban Ry.....	100	2,500,000	2,500,000	3% A., July, '98.	53	56	Pittsburg, Pa.—July 5:						
Union Depot RR.....	100	4,000,000	4,000,000	3% A., July, '98.	..	175	Allegheny County Light Co.....	100	500,000	500,000	J. & J.	127	..
San Francisco, Cal.—June.							East End Electric Light Co.....	50	800,000	800,000	Q.	..	10
California St. Cable RR.....	100	1,000,000	600,000	50c. monthly.	40	110	Philadelphia, Pa.—July 5:						
Geary Street Park & Ocean RR.....	100	1,000,000	875,000	\$2.50 share, '96.	52 1/4	53	Edison Electric Light Co.....	100	2,000,000	.....	.....	144 1/2	..
Market Street Ry.....	100	18,750,000	18,750,000	Q., 60c. per share.	52 1/4	53	*Electric Storage Battery Co. com.	100	8,500,000	.....	.....	29	29 1/2
Presidio & Ferries RR.....	100	1,000,000	550,000	.....	..	8 1/2	*Electric Storage Battery Co. pfd.	100	5,000,000	.....	.....	32	82 1/2
Seranton, Pa.—July 5:							*Penna. Ht., Lt. & Pow. Co. com.	50	5,000,000	.....	50c. p. sh., Oct. '97	..	..
Seranton Railway Co.....	50	6,000,000	2,500,000	.....	9	12	*Penna. Ht., Lt. & Pow. Co. pfd.	50	5,000,000	.....	6% Oct., '97.	..	..
m Seranton & Carbondale Trac. Co.	100	500,000	500,000	.....	..	18	Northern Elec. Light & Power Co..	10	6,500,000	550,000	\$32500 dis. Jan. 11 '97	18 1/2	14
m Seranton & Pittston Traction Co.	100	1,050,000	1,050,000	.....	..	..	Southern Elec. Light & Power Co..	10	187,500	187,500	.....	15	..
Springfield Ill.—July 5:							Miscellaneous.—July 5:						
Springfield Consolidated Ry.....	100	750,000	750,000	.....	..	11	Brush Electric Co.....	50	.....	.....	.....	82	87
Springfield O.—July 5:							Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	.....	.....	14	17 1/2
Springfield Street Ry.....	100	1,000,000	1,000,000	.....	..	2	Missouri-Edison (St. Louis).....com.	25	.....	.....	.....	18	..
Springfield, Mass.—July 5:							Eddy Electric Mfg. Co.....	25	.....	.....	.....	122	180
Springfield Street Ry.....	100	1,200,000	1,166,700	8% A.	205	210	Hartford (Conn.) Elec. Light Co....	100	850,000	.....	.....	6	11
Toronto Canada.—July 5:							Hartford (Conn.) Lt. & Power Co..	25	175,000	.....	.....	165	..
Toronto Ry. Co.....	100	6,000,000	6,000,000	1 1/2% S.	98	98 1/2	New Haven (Conn.) Elec. Lt. Co....	100	100,000	.....	.....	82	90
Montreal Street Railway Co.....	100	4,000,000	4,000,000	4% S.	257	257 1/2	Narragansett (Prov., R. I.) Elec. Co.	50	1,200,000	.....	2% Q., Oct., '96.	110	120
Washington, D. C.—July 5:							Rhode Island Elec. Protec. Co.....	100	.....	.....	.....	155	156
Belt Ry. Co.....	50	500,000	500,000	.....	..	..	Royal Elec. Co. (Montreal).....	100	1,000,000	.....	2% Q.	136 1/2	186 1/2
Capital Traction Co.....	100	112,000,000	12,000,000	65c. per sh. Oct. '97.	73 1/4	74	Toronto (Canada) Elec. Light Co..	100	1,085,000	1,085,000	1 1/2% Q.	100	100
Columbia Ry. Co.....	50	400,000	400,000	6% A.	78	80	Thomson-Houston Welding Co.....	100	.....	.....	4% S., Dec. 1, '96.	100	110
Eckington & Soldiers' Home Ry.....	50	707,000	652,000	.....	8	..	Woonsocket (R. I.) Electric Co.....	100	.....	.....	.....	..	ex d
Georgetown & Tenallytown Ry.....	50	200,000	200,000	.....	..	..				
Metropolitan RR. Co.....	50	1,000,000	453,900	2 1/2% Q.	123	124							
Worcester, Mass.—July 5:													
*Worcester Traction Co.....com.	100	8,000,000	8,000,000	.....	15	17							
*Worcester Traction Co.....6% pfd.	100	2,000,000	2,000,000	3% S., Feb., '98.	95	96							
Worcester & Suburban Street Ry...	100	550,000	542,500	4% Q., 1897.	84	..							
Wilkesbarre, Pa.—July 5:													
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1% Jan., '97.	24	29							

* Unlisted. † Paid in. ‡ Full paid. § Ex div.
 a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6% on stock per annum.
 b Consolidated. c Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
 d Practically all shares owned by Union Traction Company.
 e Leased to

BONDS.

PASSENGER RAILWAY.

PASSENGER RAILWAY.

NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						
NAME.							Amount.						

PASSENGER RAILWAY.

NAME.	Amount.		Due	Interest periods.	Bid.	Asked.
	Authorized.	Issued.				
St. Louis.						
Date of Quotation—July 5, 1898						
Fourth St. & Arsenal St. Ry.....1st mtg. 6s.	\$50,000	\$50,000	1908	J. & J.	97	100
Jefferson Avenue Ry.....1st mtg. 6s.	400,000	400,000	1906	M. & N.	100	102
Lindell Ry. Co.....1st mtg. 6s.	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co.....1st mtg. 6s.	1,000,000	700,000	1916	M. & S.	108	107
Mount City RR. Co.....1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co.....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
People's RR. Co.....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	.....	.....
St. Louis & E. St. L. Electric.....1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....1st mtg. 6s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
St. Louis & Sub. Ry.....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry.....Income 5s.	800,000	800,000	.....	.....	60	64
Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
Taylor Avenue St. Ry.....1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.....Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	118	114
†Controlled by St. Louis RR. Co.						
†Controlled by Union Depot RR. Co.						
†Controlled by Lindell RR. Co.						
†\$200,000 in escrow to retire 1st & 2d mtg.						
†\$500,000 in escrow.						
†\$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—June, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	.....
Ferris & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	.....	117
Geary St., Park & Ocean RR.....1st mtg. 6s.	1,000,000	671,000	1921	A. & O.	.....	102
Market St. Cable Ry. Co.....1st mtg. g. 5s.	8,000,000	8,000,000	1918	J. & J.	127	129½
Metropolitan Ry. Co.....1st mtg.	200,000	.....	.....	.....	.....	.....
Omnibus Cable Co.....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
Park & Cliff House RR.....1st mtg. 6s.	850,000	850,000	1912	J. & J.	10½	.....
Park & Ocean RR.....1st mtg. 6s.	250,000	250,000	1914	J. & J.	110	115
Powell St. Ry.....1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co.....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109½	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 5, 1898.						
Belt Ry. Co.....Cons. mtg. 5s.	500,000	450,000	1920	J. & J.	45	.....
Columbia Ry.....1st mtg. 6s.	500,000	500,000	1914	A. & O.	114	.....
Eckington & Soldiers' Home.....1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll. tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†\$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—July 5, 1898.						
Bridgeport Traction Co.....1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.....Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	109	111
Citizens' St. R. (Ind'polis).....1st cons. m. 5s.	4,000,000	8,000,000	1933	M. & N.	79	80
Croswell St. Ry. (Buffalo).....1st mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	107	109
Columbus (O.) St. Ry.....1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.).....1st mtg. 5s.	15,000,000	13,965,000	1933	J. & D.	104	104½
Croswell St. Ry. (Colu's, O.).....1st mtg. g. 5s.	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry.....1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	.....	.....
Denver Co. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry.....1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
Minneapolis St. Ry.....1st cons. mtg. g. 5s.	5,000,000	1,050,000	1919	J. & J.	89	93
No. Hudson Co. Ry. (N. J.).....Cons. mtg. 5s.	8,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N. J.).....2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	.....
No. Hudson Co. Ry. (N. J.).....Deb. 6s.	500,000	439,000	1902	F. & A.	112	.....
Paterson (N. J.) Ry.....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Recheater (N. Y.) Ry.....1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95½	.....
St. Paul City Ry.....Cons. g. 5s.	5,400,000	4,298,000	1937	.....	89	92
St. Paul City Ry.....Deb. g. 6s.	1,000,000	1,000,000	1900	.....	85	92½
†\$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
†\$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
†\$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
†\$37,000 in treasury.						
†\$960,000 res'ed to redeem prior liens.						
†\$620,000 in escrow.						

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—July 5, 1898.						
Edison Elec. Illuminating Co., Boston	2,026,000	.....	Quar.	156	.....	.....
General Electric Co., gold coup. deb. 5s.	10,000,000	8,750,000	1922	.....	108	.....
Pittsburg, Pa.						
Date of Quotation—July 5, 1898.						
Allegheny County Light Co. 6s.	500,000	.....	1911	J. & J.	106	.....
Allegheny City Electric Light Co. 4s.	250,000	.....	1918	A. & O.	.....	.....
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	.....	.....	M. & S.	.....	.....
Miscellaneous. —(July 5, 1898.)						
Edison El. Ilig. Co. (N. York) 1st m. 5s.	4,812,000	4,812,000	1910	.....	110	.....
Edison El. Ilig. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,160,000	1938	.....	117½	.....
Edison Elec. Ilig. Co. (Brooklyn) 5s.	2,500,000	1,500,000	1940	.....	111	112
Edison Electric Light (Philadelphia) 6s.	2,000,000	.....	.....	.....	103	.....
Edison Ilig. Co. (St. Louis) 4s.	4,000,000	.....	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis) 1st mtg. 6s.	500,000	.....	1909	A. & O.	.....	.....
Mo. Elec. Lt. Co. (St. Louis) 2d mtg. 6s.	600,000	.....	1921	Q'ry.	.....	.....
United Elec. Light & Power Co. (N. Y.) 5s.	5,000,000	.....	.....	.....	75	90

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—July 5, 1898.						
American Bell Telephone Co. 7s.	.....	.....	1898	F. & A.	100½	.....
Northwestern Telegraph Co. 7s.	.....	.....	.....	.....	.....	.....
N. Y. & N. J. Telep & Telg. Co. gen. mtg. 5s.	.....	.....	.....	.....	108	.....
Chesapeake & Potomac Teleph. Co. 5s.	.....	.....	1911	J. & D.	108½	.....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—July 5, 1898.						
American Electric Heating Co. 5s.	500,000	500,000	.....	.....	15	19
Armington & Sims Eng. Co. 5s.	.....	.....	.....	.....	35	.....
Barney & Smith Car Co. 7s.	.....	.....	1912	J. & J.	95	100
Carborundum Mfg. Co. 5s.	.....	.....	1904	M. & S.	.....	.....
Worthington Pump Co. 5s.	95,000	.....	.....	.....	.....	.....
Unlisted						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11½@11½c.; Lake, 11½@12c.; casting, 11½@11½c.

The Baltimore Consolidated Railway Company has purchased the uncompleted trolley line between Baltimore and Ellicott City from the Columbia & Maryland Electric Railway Company.

Bridge Commissioner Shea has notified the trolley companies using the Brooklyn Bridge that they must agree to the new schedule of car tolls at once. If the companies object the matter will be put in the hands of the Corporation Counsel.

The application of the Nassau Electric Railroad Company of Brooklyn, N. Y., for permission to increase the capital stock of the company from \$6,000,000 to \$15,000,000, was submitted to the State Railroad Commission by Gen. B. F. Tracy, representing the company, on the 29th ult. There was no opposition. The Commission took the papers in the case and promised to render a decision at an early date.

Halgarten & Co., New York, announce that they have consented to accept deposit of the 5 per cent. second mortgage bonds of the Staten Island Rapid Transit Railroad Company, guaranteed by the Baltimore & Ohio Railroad Company, under the mortgage of November 21, 1885, and to act for the bondholders in devising and promoting a reorganization of the property covered by the mortgage and preserving the bondholders' interest.

Redmond, Kerr & Co., New York, in their financial report issued on the 2d inst. say: "The usual conditions attending the close of the half-year and preceding the July 4th period have prevailed this week in Wall Street. There has been no important war news to change the course of events, and business has been chiefly of a routine character. At present there is a disposition in financial circles to hold active operations in abeyance until the occupation of Manila and Santiago by the American forces is an established fact."

A Boston financial paper states that "the directors of the Electrolytic Salts Company have declared a dividend of 3 per cent. to stockholders of record of June 22, payable July 15. Since February 4, 940.43 ounces of gold have been received and 1,834.51 ounces of silver. Over 5,000,000 tons of seawater have been treated by the accumulators to produce the above result. Three hundred men are now at work constructing what is known as plant No. 2."

A mortgage for \$1,500,000, executed by the New York & North Shore Railroad Company, was filed in the office of the clerk of Queens County at Jamaica, L. I., last week. The mortgage names the New York Security & Trust Company as trustee to secure the payment of 1,500 thirty-year gold bonds of the denomination of \$1,000 each. The New York & North Shore Railroad Company is a new corporation, organized by the managers of the New York & Queens County Trolley Company, which owns the trolley lines in Long Island City.

The N. Y. "News Bureau" says: "We understand that the differences between the preferred and common stockholders of the General Electric Company have been settled privately. It is proposed to reduce both classes of stock 40 per cent. in par value and to pay all the back dividends on the preferred stock in cash. The common stock, after the reduction in par value, will be placed on a 6 per cent. dividend paying basis. The company, it is claimed, has the cash on hand to pay the deferred dividends on the preferred and to begin quarterly payments on the common."

The directors of the Metropolitan Street Railway, New York, announced on Friday that it had been decided to distribute to the stockholders the accumulated surplus, now amounting to \$26,793,000. A cash dividend of \$20 will be paid to stockholders of record on August 15, in addition to the regular 2 per cent. quarterly dividend. This will call for \$7,200,000 cash. In October the company will increase its capital stock to \$54,000,000, each shareholder receiving one share of the new stock for each two shares held by him. The shareholders thus receive extra dividends of 70 per cent., 20 per cent. in cash and 50 per cent. in stock.

The stockholders of the Potomac Electric Power Company, Washington, D. C., at a meeting on Wednesday last adopted a resolution increasing the capital stock to \$1,000,000, of which \$250,000 shall be 6 per cent. voting, non-cumulative preferred stock, divided into 2,500 shares of \$100 each, and \$750,000 shall be common stock, divided into 7,500 shares of the par value of \$100 each. The present capital stock is \$500,000, fully paid, and the total liabilities and debts amount to \$380,000. The company also placed on file a deed of trust to the United States Mortgage & Trust Company, to secure the payment of \$750,000 in \$1,000 bonds, payable June 1, 1948, with interest at 5 per cent., payable semi-annually. The deed covers all the company's property, rights and franchises.

"A deal of great importance to our trolley lines is reported to be under way," says the N. Y. "News Bureau." "It is to the effect that the Philadelphia syndicate, which includes William C. Whitney, W. L. Elkins, P. A. B. Widener and Thomas Dolan, and which has made such successful ventures in establishing or reorganizing trolley companies, notably the Metropolitan Street Railroad Company, is now seeking to secure control of the Brooklyn Rapid Transit Company. It is known that these capitalists are in the market for valuable surface lines and franchises, and are thoroughly conversant with the present and prospective future values of that class of properties. It is believed that they have been careful students of the situation in Brooklyn and are now and have for some time been steady buyers of the company's stock. The report is to the further effect that the action of the syndicate is with the consent of the interests represented by former Governor Flower and that the latter is an active participant in the scheme."

The new tax law in regard to street railways recently passed by the Massachusetts Legislature goes into effect in October. It differs radically from the present law in regard to taxing the property of street railways. Under the present law the real estate and machinery of a street railway company are taxed direct by the city or town in which they are located. The Commissioner of Corporations reports the difference between the town tax and the amount of the tax on the capital stock, and the State collects the tax upon this difference. The money obtained in this manner is distributed among the towns and cities of the commonwealth in proportion to the amount of stock in the corporation held by its taxpayers. Under the new law the State will collect the excess tax, but it will be distributed according to the mileage of street railway in a town or city. Each railway will be considered separately in the distribution. If the tax on a street railway be \$5,000, and there be two miles of track in one city and three in another, the first city will receive \$2,000 and the other \$3,000. There is also to be an excise tax based on the amount of gross receipts per mile of track. The tax is regulated by a graduated scale according to the amount of earnings. The per cent. per amount of earnings is as follows: For less than \$4,000, 1 per cent.; for more than \$4,000 and less than \$7,000, 2 per cent.; for more than \$7,000 and less than \$14,000, 2½ per cent.; for more than \$14,000 and less than \$21,000, 3 per cent.; for more than \$21,000 and less than \$28,000, 3½ per cent.; for more than \$28,000, 4 per cent. In return for the "excise tax," as it has been called, the railroads are released from the care of streets, paving and the removal of snow, excepting in the tracks, and from all restrictions in franchises granted for extensions. When a change of grade or relocation of street is made the railroad must pay a part of the expense, not to exceed one-fourth of the total, including the cost of the relocation of the tracks. The board of aldermen shall determine what proportion the railroad shall pay, but appeal may be made to the Superior Court, as in the case of other betterments. To meet this expense the railroad may increase the amount of stock with the consent of the Railroad Commissioners, and stock may also be issued to pay for extensions.

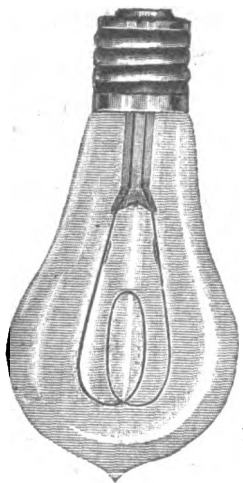
ELECTRICITY

Vol. XIV.

NEW YORK, JANUARY 12, 1898.

No. 1

Beacon Lamp Co.,



New Brunswick,
N. J.

HIGH GRADE
Standard Lamps

ALSO FOR

Multiple Series,
Miniature and
Decorative Work.

Not a member of
the Lamp Trust.

Royal Electric Co. of Montreal, Agents for Canada.
Will & Flack Company, San Francisco, Pacific
Coast Agents.

The only Rubber Insulation Receiving
Medals of Award at World's Fair, 1893.

INSULATED WIRES AND CABLES.

Aerial, Underground, Submarine and
Interior Use.



KERITE TAPE.

W. R. BRIXEY,
MANUFACTURER,
203 Broadway,
New York.

Wallace Electric Co.,
Western Agts., Chicago.
California Electric Works,
San Francisco, Cal.
M. Du Perow,
Washington, D. C.

ELECTRICAL

Watchman's Time Detectors,
Magnet Watchman's Clock,
Electric Time System, Em-
ployee's Time Registers (3
kinds), Interior Telephones
(Intercommunicating).

Address for catalogues and
prices

The American Watchman's
Time Detector Co.,
J. S. MORSE, Treasurer,
234-235 Broadway, New York.

Electrical Machinery.
WARREN P. FREEMAN COMPANY
106-108 Liberty Street, New York.
Automatic Machinery of every description and
Experimental Work, electrical and mechanical.



1889

Paris
Exposition

MEDAL



1893

World's
Fair

MEDAL



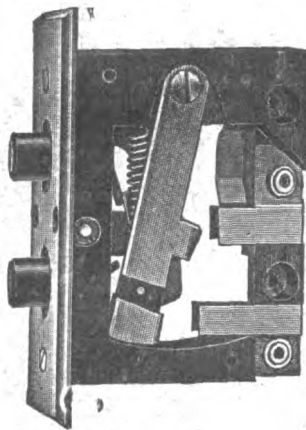
The Standard for Rubber Insulation.

Okonite Wires, Okonite Tape, Manson Tape,
Candee Water-proof Wire.

Sole Manufacturers, THE OKONITE CO., Ltd.

WILLARD L. CANDEE, } Managers.
H. DURANT CHEEVER, } 253 BROADWAY,
GEO. T. MANSON, General Supt. NEW YORK.
W. H. HODGINS, Secretary.

The Improved Stevens Flush Switch.



Embodies the very
highest points of
superiority in Flush
Switches.

Single Pole, Double Pole;
Three Way, Four Way.

Single Switches or in gangs of any number.

Mats of any kind of wood to match house furnish-
ings; also open and closed wall boxes for single
switches or gangs of any number of switches.

Write for Prices and Discounts.

THE ELECTRIC PROTECTION COMPANY, MANUFACTURERS,

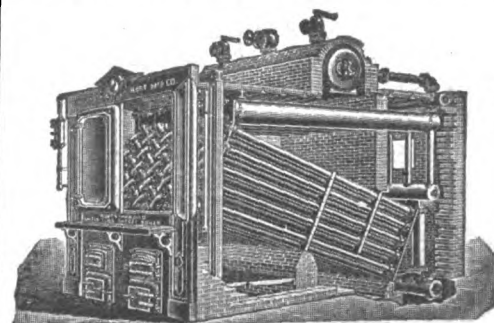
1026-1028 Filbert Street,

Philadelphia, Pa.

NEW YORK: CHAS. D. SHAIN, 136 Liberty Street.

GEO. W. CONOVER, 1511 Monadnock Block, Chicago, Ill., agent for Michigan, Indiana, Illinois,
Wisconsin, Minnesota, Iowa and Missouri and the city of Cincinnati.
Pacific Coast—California Electrical Works, San Francisco, Cal.

ROOT IMPROVED WATER TUBE BOILER.



SELLING AGENTS:

Monadnock Block, Chicago, Ill.
Security Building, St. Louis, Mo.

Abendroth & Root Mfg. Co.,
28 CLIFF ST., NEW YORK.

A RED CAT.

Our General Catalogue, Number Twelve,
is an encyclopedia of electrical supplies.
Send for a copy.

ELECTRIC APPLIANCE COMPANY,
ELECTRICAL SUPPLIES.
242 Madison St.
CHICAGO.

GRIMSHAW WHITE CORE WIRES,

Grimshaw White and Black Tapes,
Competition Line Wires,
Raven White Core Wires,
Vulca Electrical Wire Duets.

MANUFACTURED BY

NEW YORK INSULATED WIRE CO.,

Chicago, New York, Boston,
320 Dearborn St. 15 Cortlandt St. 184 Congress St.
San Francisco, Cal., 115 New Montgomery St.

HABIRSHAW INSULATED WIRES AND CABLES. GLENWOOD WORKS, YONKERS, N. Y.

New York Office, 15 Cortlandt Street. Tel-
ephone Call, 191 Cortlandt.

G. WILFRED PEARCE,

Electrical, Steam and Compressed Air Apparatus,
SAINT PAUL BUILDING,
NEW YORK.

CENTURY LEAD ENCASED CABLES.

CREFELD ELECTRICAL WORKS,
620 Atlantic Ave., Boston, Mass.

DO YOU NEED SMALL DRY BATTERIES?

If so, write and tell what you want.
5/8x2 1/2 inches 1.5 volts; 5/8x2 1/4 inches 5 amperes.
VITALIS HIMMER,
Pioneer Manufacturer of Dry Batteries,
162 William Street, New York.



STANDARD UNDERGROUND CABLE CO.,

Pittsburg—Chicago—New York,
Philadelphia.

PAPER, FIBER, RUBBER
TELEPHONE
AERIAL

FIBER, RUBBER, PAPER
TELEGRAPH
HOUSE

RUBBER, PAPER, FIBER
ELECTRIC LIGHT
UNDERGROUND

FOR ALL SERVICE
POWER
SUB



—FOR SALE:—

Second Hand

Direct Current Dynamos of 350, 700, 725, 800, 810, 900, 1075, 1350, 1610 and 2500 light capacity.
 Alternating current dynamos of 750, 900, 1300 and 2000 light capacities.
 Arc dynamos, 20, 24, 30, 40, 50 and 60 light, both 1200 and 2000 C. P.
 Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 H. P. Boilers, 100, 250, 375 and 500 H. P.
 Heaters, 150 and 1,000 H. P. Pumps, all sizes.

Write us for particulars and prices.

CHICAGO EDISON COMPANY,

139 ADAMS STREET, CHICAGO.

NEURALGIA

SICK AND NERVOUS HEADACHES
 POSITIVELY CURED IN THIRTY MINUTES.

Anti-Neuralgic

A purely vegetable compound which seeks the root of trouble and eradicates it; which builds up the nerves, making them strong, which in itself is a guarantee against a return of the trouble.

At all druggists or sent postpaid upon receipt of One Dollar.

FRENCH CHEMICAL CO.,
 356 Dearborn Street, CHICAGO, ILL.

This Has Never Failed to Cure.

Paillard

Non-Magnetic

WATCHES.

Endorsed by the ...
 greatest electricians and scientists of the world.

For descriptive circular write ...

A. C. BECKEN,

103 State Street,
 CHICAGO, ILL.



“Perfection is the Aim of Invention.”

Franklin No. 5

The best writing machine on the market.

Easy
 to
 operate.



The writing
 is always
 in sight.

PRICE \$75.00.

TOWER, DAWSON & CO.,

306 and 308 Broadway, NEW YORK, N. Y.
 DESCRIPTIVE BOOKLET SENT ON REQUEST.

INDIA
 and
 AMBER

MICA

Uncut or Cut to any
 Size or Pattern.
 Washers.

SAMPLES AND QUOTATIONS FURNISHED.

A. O. SCHOONMAKER, 158 William Street, New York.

McIntire's Patent Connectors and Terminals.

FUSED WIRE, FUSED LINKS AND STRIPS.

The C. MCINTIRE CO., 13 and 15 Franklin Street, NEWARK, N. J.

ROBERTS' SLIDE RULE WIRING CALCULATOR.

The most convenient device yet constructed for giving Size of Wire, Volt Loss, Area, Carrying Capacity, etc. Vest pocket size; leather case. Fifty cents, postpaid. Send orders to

ELECTRICITY, 136 Liberty St., New York.

FLORIDA MID-WINTER SUN BATHS.

LOW RATES to Charleston, Savannah
 Jacksonville and all points South.

via Clyde Line to Florida Without Change.

New York to
 Charleston, S. C.,
 direct.

Tri-weekly Sailings
 at 3 P. M. from
 Pier 29, E. R.
 New York.

Steamships—
 “Comanche,”
 “Iroquois,”
 “Algonquin,”
 “Seminole”
 and “Cherokee”
 are the smoothest
 sailing passenger
 ships to the South.

Steamers arrive at
 Jacksonville in
 daylight, connect-
 ing with outgoing
 morning trains.

NORTH & SOUTH
 TRAVEL BY THE

CLYDE LINE

NEW YORK
 CHARLESTON, S.C.
 AND
 FLORIDA

UNSURPASSED
 PASSENGER
 ACCOMMODATIONS

WM. P. CLYDE & CO. GENERAL AGENTS.

New York to
 Jacksonville, Fla.,
 without change.

Avoid delays and
 transfers. Take
 CLYDE LINE.

Tickets include
 meals and
 stateroom berth,
 thus making the cost
 about 40 PER CENT.
 LESS THAN VIA
 ALL RAIL.
 All Clyde Steamers
 are lighted by
 electricity.

Cuisine the very
 best. Unsurpassed
 Cabin Accommoda-
 tions.
 Beautifully illus-
 trated Booklet
 Gratis.

THEO. G. EGER, T.M., W. H. HENDERSON, G.E.P.A., W. H. WARBURTON, G.T.P.A.
 5 Bowling Green, New York

FRANK N. PHILLIPS, President.
OMAR H. WAGNER, Treas.

EUGENE F. PHILLIPS,
General Manager.

E. ROWLAND PHILLIPS, Vice-President.
OMAR R. REMINGTON, JR., Secretary.

American Electrical Works.

Providence, R. I.

Bare & Insulated Electric Wire.

Electric Light Line Wire.
Incandescent and Flexible Cords.

Railway Feeder
and Trolley Wire.

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
Cables for Aerial and Underground Use.

New York Store—P. C. ACKERMAN, 10 CORTLANDT STREET.

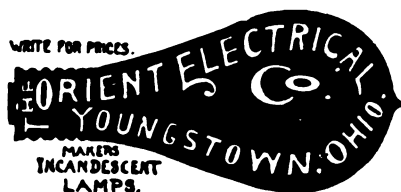
Chicago Store—P. E. DONOHUE, 241 MADISON STREET.

Montreal Branch—EUGENE F. PHILLIPS' ELECTRICAL WORKS.



Automatic Motor
Rheostats.

WARD LEONARD ELECTRIC CO.,
Bronxville, N. Y., U. S. A.



DON'T BE
"A BUTTON PRESSER,"

for he is a poor specimen of humanity
who is contented to press the button,
let others do the rest, and then claim
the results as his own. To become a
successful Photographer you must read

THE PHOTOGRAPHIC TIMES.
Go and to East 17th St., New York City.
Send 15 cents for a sample number, containing
a beautiful photographic frontispiece and from
40 to 50 illustrations, including reproductions
of the works of the principal amateur and pro-
fessional photographers of the world.



Blue Print Paper
for making duplicate copies of drawings.
Finest quality. Lowest price.

WE MANUFACTURE

Drawing Instruments
of the finest grade. Send for Catalogue D.
Drawing paper and supplies. Cameras and
photo materials. Bon Ton Cameras 8 1/2 x 8 1/2
in., delivered at any express office. Finest 28
Camera, Catalogue P.

THOS. H. McCALLIN & CO.,

1080 Arch Street, Philadelphia.

Blair's
Ink Making
Security
Fountain
Pens.

Producing their own ink by
merely filling the holder with
water, which turns into a deep
black, purple or scarlet copying
ink, enabling the owner to pro-
duce the right ink at any time or
place. The ink-making quality
will last one year and can be re-
newed at a trifling cost, saving
the price of the pen in a few
months.

They cannot leak.
No weak internal mechanism.
Regular shape 14 carat Gold
Pens.
Upper feed bars on long point
pens.
Under feed bars on short point.
They cost no more, even con-
siderably less, than the old
makes.
More than 12,000 sold in six
weeks.

To give our readers this Absolu-
tely Perfect Fountain Pen at a
moderate price, we have made an
arrangement with Blair's Foun-
tain Pen Company of New York to
furnish our subscribers their
"Security Fountain Pens" at the
following low

PRICES:

No. 1 Gold Pen, fine point, at \$1.75.
No. 2 Gold Pen, fine or stub point, \$2.
No. 3 Gold Pen, fine or stub point, \$2.50.
No. 4 Gold Pen, fine or stub point, \$3.
Handsomely Chased and Gold Mounted,
75 cents extra.

To insure getting these pens at prices
named, orders for them should be sent
direct to this office with the price of the
pen desired. Should you wish to have
them insured against loss in the mails, send
eight cents extra. Address

ELECTRICITY NEWSPAPER CO.,
136 Liberty St., New York.

"Standard Wiring,"

FOR ELECTRIC LIGHT AND POWER.

By H. C. CUSHING, JR.,

Electrical Inspector Fire Underwriters' Tariff
Association of New York.

Adopted by the Fire Underwriters of
the United States.

It contains tables, formulas and rules for every
system of inside and outside wiring. Fifth
edition. Russia leather cover. Price \$1.

Address

ELECTRICITY NEWSPAPER CO.,
136 Liberty Street, New York.

Photographs of Vacuum



First produced by us to show the
unmistakable difference between the
grade of vacuum in various lamps on
the market. We should be glad to
send the photographs to any Central
Station, Electrical Engineer or Dealer.

Also microscopic photograph (enlarged 30 diam-
eters) of prominent lamp filaments.

Factory:
Marlboro,
Mass.

BRYAN-MARSH CO.

Office:
136 Liberty St.,
New York.

American Electric Telephone Co.,

171-173 S. Canal St.,

CHICAGO, ILL., U. S. A.,

MANUFACTURERS OF

High Grade Telephone Apparatus, Long
Distance Series and Bridging Type Tele-
phones, Repeating Coils, Distributing
Boards, etc., etc.

WE NOW HAVE READY FOR
THE MARKET OUR NEW

"Express" Switchboard.

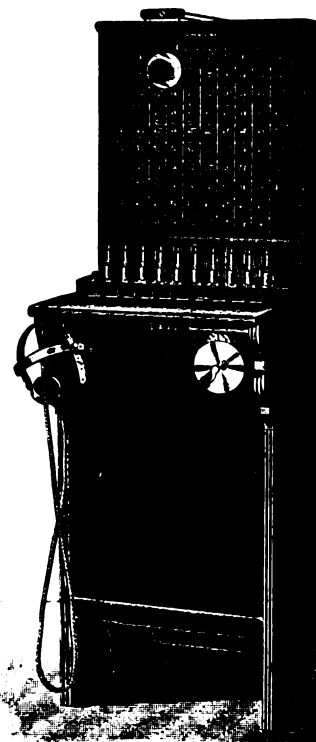
This Board is a New Departure, the most
Rapid Switching Apparatus ever devised, and
will pay a daily dividend in quality of ser-
vice rendered.

Self-restoring Drop.
Self-restoring Ring-off.
Rapid Ringing Device.

Each Drop and Jack Self-Contained in a
Hard Rubber Case, can be removed and re-
placed in Board in one minute without dis-
turbance a single connection.

Each Drop indicates if line is working
properly.

Correspondence Solicited.
All Goods Guaranteed.



Complete 100 Drop "Express" Switchboard.

American Electric Telephone Co.

INDIA
and
AMBER

MICA

EUGENE MUNSSELL & CO.,
NEW YORK: 218 Water St.

\$50

worth of Electrical Apparatus, including a Dynamic, sent
with our Complete Electrical and Mechanical Engineering
Course. This is not a prize offer. This apparatus is re-
quired by students. They have hitherto had to pay extra
for it. We will, for a short time, give it free to those who
enroll. Our 72-page Catalogue, free to any address, explains.

FREE

Institute for Home Study of Engineering, 55-56 Blackstone Building, Cleveland, O.

Habirshaw Wires and Cables

are the product of the best materials and skill in manufacture. They have long been recognized as the most **RELIABLE, DURABLE** and **ECONOMICAL** for all classes of work requiring the use of high-grade insulation. The danger of high potential transmission currents is eliminated when the circuits are installed with

HABIRSHAW

Red Core—White Core—Blue Core.

INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY,

J. W. GODFREY, Manager of Sales,
6198 15 Cortlandt Street, New York City.

Main Office: GLENWOOD WORKS, YONKERS, N. Y.

ALPHABETICAL INDEX TO ADVERTISEMENTS.

For Classified Index See Page VIII.

A		E		I		P	
Abendroth & Root Mfg. Co.....	i	Electrical Exhibition Co.....	xii	India Rubber & Gutta Percha Insulating Co. i-iv		Pierce, A. M.....	
American Watchman's Time Detector Co.....	i	Electric Appliance Co.....	i	International Correspondence School.....	vii	Pearce, Wilfred G.....	v
American Electric Telephone Co.....	iii	Electric Engineering Co.....	vii			Pratt & Co., O. L.....	
American Electric Works.....	iii	Electric Storage Battery Co., The.....	vi				
Ames & Co., A. E.....	vii	Electric Protection Co., The.....	i				
Anderson, Albert and J. M.....							
B		F		L		S	
Bechen, A. C.....	ii	Farr Telephone & Construction Co.....	xii	Leonard Electric Co., Ward.....	iii	Schoonmaker, A. O.....	ii
Brixey, W. R.....	ii	Fowler, Dawson & Co.....	ii			Siemens & Halske Electric Co.....	xi
Baker & Co.....	vii	Warren P. Freeman Company.....	i			Standard Underground Cable Co.....	i
Barbour, John B., Jr.....	vii	Fort Wayne Electric Corporation.....		McRae, A. L., St. Louis, Mo.....	vii	Stanley Electric Mfg. Co.....	xi
Beacon Lamp Co.....	i	French Chemical Co.....	ii	McIntire Co., The C.....	ii	Strathy & Co., Gordon.....	vii
Blair's Fountain Pen Co.....	iii			Munsell, Eugene & Co.....	iii		
Bryan-Marsh Co.....	iii			McCallin & Co., Thos. H.....	iii		
Buckeye Electric Co.....	xii						
C		G		N		T	
Clyde Steamship Line.....	ii	Graham Equipment Co.....		New York Central Railroad.....	iii	The Imperial Electric Co.....	vi
Chicago Edison Company.....	ii	Gordon Burnham Battery Company.....	vi	New York Insulated Wire Co.....	i	The Photographic Times.....	
Consolidated Typewriter Exchange.....	vii	Goubert Mfg. Co.....	vi	Northwestern Telephone Mfg. Co.....	vii	Trask & Co., Spencer.....	vii
Orefield Electrical Works.....	i	Gould & Eberhardt.....		Nugent & Co., C. Franklin.....	vii		
Colburn Electric Mfg. Co.....	iv						
D		H		O		W	
Diamond Electric Co.....	xii	Himmer, Vitalis.....	i	Okonite Co., The.....	i	Western Telephone Construction Co.....	vi
Dixon Crucible Co.....	vi	Horn, M. T.....	vii	Orient Electrical Company.....	iii	Weston Electrical Instrument Co.....	ix
		Hambleton & Co.....	vii			Whitaker & Hodgman.....	vii
		Hutton & Co., W. E.....	vii				

ANY

ELECTRICAL BOOK Published in America or Europe will be sent postpaid on receipt of price by

ELECTRICITY NEWSPAPER CO., 136 Liberty Street, N. Y.

Many Publications Have a

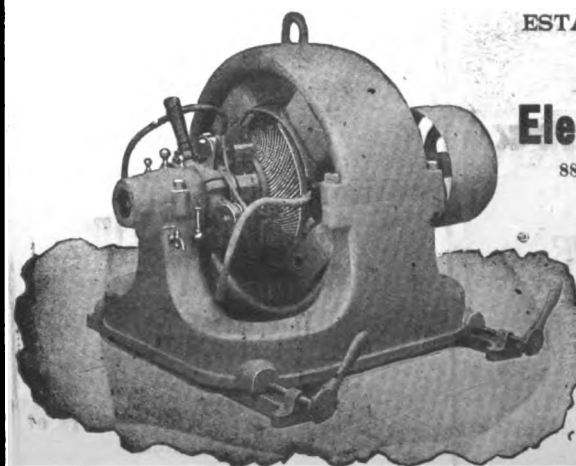
Waste of Circulation

made up of the copies that go to people who never will be buyers of your goods.

ELECTRICITY

Has No Waste Circulation.

THIS IS ONE OF THE REASONS WHY IT IS A BETTER ADVERTISING MEDIUM THAN ANY OTHER ELECTRICAL JOURNAL.



ESTABLISHED 1881.

Colburn Electric Mfg. Co.,

888 Main St., Fitchburg, Mass.

Manufacturers of

Incandescent Lighting.

Electric Power AND

ELECTRO-PLATING MACHINES.

THE Latest Designs.

THE Highest Efficiency.

WESTERN AGENTS:

Baker Bros., Erie Street, Toledo, Ohio. Missouri Electric Repair Co., 16 So. 9th St., St. Louis, Mo.
Illinois Electric Co. 1586 Monadnock Block, Chicago. Mr. C. P. Hutchinson, Salt Lake City.

THE BEST BOOKS

FOR

AMATEURS AND ELECTRICAL WORKERS.

ELECTRICAL INSTRUMENT MAKING FOR AMATEURS.—A practical Hand-book with 48 Illustrations. By S. R. Bottone. 12mo cloth.——

\$0.50

DYNAMO AND MOTOR BUILDING FOR AMATEURS.—A concise hand-book illustrated with working drawings. By C. D. Parkhurst. 12mo cloth.——

1.00

ELECTRIC TOY MAKING FOR AMATEURS.—A fully illustrated description showing how to construct Batteries, Magnets, Motors, Dynamos and miscellaneous toys. By T. O'Connor Sloane. 12mo cloth.——

1.00

DOMESTIC ELECTRICAL WORK.—Tells how to wire buildings for Bells, Burglar Alarms, Annunciators, Electric Gas Lighting, etc. Illustrated with 22 diagrams. By W. A. Wittbecker. 12mo paper.——

\$0.25

PRACTICAL ELECTRICIANS.—A universal hand-book on every-day electrical matters, including Bells, Carbons, Induction, Intensity and Resistance Cells, Dynamos, Measurements, Microphones, Phonographs, Storage Batteries and Telephones. pp. 135. 12mo cloth.——

0.75

Any of These Works Sent Postpaid Upon Receipt of Price.

The set of five and one year's subscription to **ELECTRICITY** will be sent for \$5.00.

ELECTRICITY NEWSPAPER CO.,

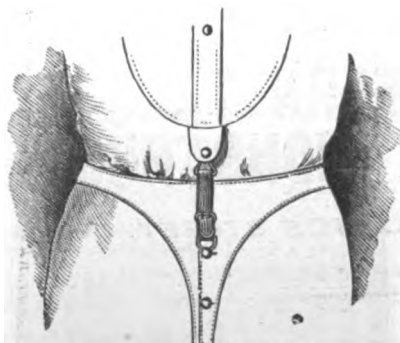
136 LIBERTY ST., NEW YORK.

"Hold-em"

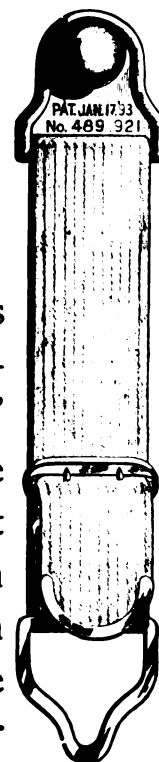
Holds down your shirt.

Holds up your Drawers.

A tab at the lower end of the bosom is a useless method—tapes on the drawers are always broken—both were invented to exasperate the wearer. "Hold-em" makes this useless tab useful; buttons stay on the drawers; the shirt bosom don't wrinkle—the shirt stays down and the drawers stay up. Worn on first or second button of drawers. Souls with corporations use the top button—thin people use the next. Comfort and contour dictate. For 15 cents, stamps or silver, we send a "Hold-em" post paid.



Worn as above.



Exact size. Is handsomely and neatly made of colored silk elastic and nickel trimmings.

SHAIN COMPANY,

136 Liberty Street, New York.

It is invaluable for the full dress shirt.

TRADE MARK
"Chloride Accumulator"

REGISTERED SEPTEMBER 11, 1904.

The Western Union Telegraph Company
is installing in its Memphis office
436 Chloride Accumulators
displacing
5,250 gravity cells.

Atlanta, Washington, New Orleans and eighteen smaller offices are already equipped with Chloride Accumulators, which have effected a great reduction in cost of maintenance and an improvement in the wire service.

THE ELECTRIC STORAGE BATTERY COMPANY,
Drexel Building, Philadelphia, Pa.

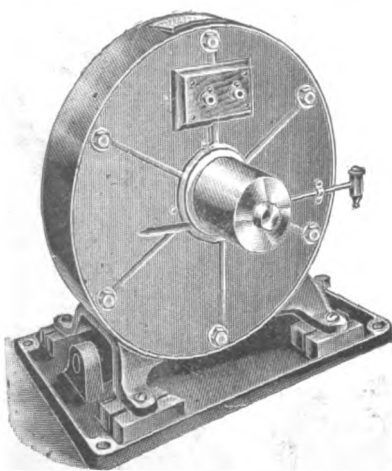
BRANCH OFFICES:

NEW YORK, 20-22 Broad St.
BOSTON, MASS., 60 State Street.

CHICAGO, ILL., 1543 Marquette Building.
SAN FRANCISCO, CAL., 222 Market Street.
BALTIMORE, 641 Equitable Building.

C. L. Pratt & Co.,
Chicago.
Havana Cigars.

We give an extra discount to patrons of this paper.
Importers, Jobbers and Manufacturers. Box Trade a Specialty.
82 and 84 Madison Street,
McVicker Theatre Building.



A Slow-Speed, Direct-Current Motor for
Composing Machines, Job Presses, etc.

All the conditions that have so long puzzled publishers and printers met in the

Imperial Electric Motor.

Direct transmission of power—No counter-shafts, no belting—Only 350 revolutions a minute—One-fourth to one-half horse power—Automatic lubrication—No attention required.

LOW IN PRICE—ECONOMICAL TO RUN.

Manufactured by the
IMPERIAL ELECTRIC CO.,
New York.

Sole Selling Agents:

BULLOCK ELECTRIC COMPANY,
218 Broadway, New York.
ELECTRIC SAND, best primary battery compound.

Gordon Primary Cell.



Flow on, electric currents, flow,
Forever and forever;
Cells may come and cells may go,
But the Gordon cell will live forever.

The Gordon Cell will live on its merits, and if you wish to learn its merits apply for circular and price list.

GORDON-BURNHAM BATTERY CO.,
82 to 86 West Broadway, New York.

GRAPHITE RESISTANCE.

Graphite resistance in rods, tubes or otherwise. Any resistance wanted—one ohm to one million ohms. Write for particulars.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

CANDY CATHARTIC
Cascarets
CURE CONSTIPATION
REGULATE THE LIVER
ALL DRUGGISTS

10¢ 25¢ 50¢
ABSOLUTELY GUARANTEED to cure any case of constipation. Cascarets are the Ideal Laxative, never grip or gripe, but cause easy natural results. Sample and booklet free. Ad. STERLING REMEDY CO., Chicago, Montreal, Can., or New York. \$11.4



WESTERN TELEPHONE
CONSTRUCTION CO.,

250 S. CLINTON STREET, CHICAGO.

LARGEST MANUFACTURERS OF

Telephones and Appliances,

EXCLUSIVELY, IN THE UNITED STATES.

SITUATIONS WANTED.**Free Advertising.**

Inquiries from those seeking employment as Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or in other positions requiring technical experience or intimate acquaintance with the electrical trade, will be inserted in this column Without Charge. Each advertiser is invited to repeat his advertisement in case the first one produces no results.

It is the desire of the management of this paper to bring the unemployed and the employer together to their mutual benefit, and to this end they invite the former to make use of this column without charge. No advertisement exceeding five lines (about 35 words) will be inserted, but advertisers may write fully of their qualifications and these letters will be kept on file for future reference in filling vacancies which may occur.

Applicants should write clearly and distinctly and enclose postage to insure attention.

Address all communications to Free Advertising Editor, "Electricity," New York.

31 WANTED.—Position by an electrician; age 25, married; over seven years' practical experience in light and power work, installing generators and motors, also all systems of arc and incandescent wiring and line work. Address A. K., care ELECTRICITY.

32 WANTED.—Position as manager or superintendent; interurban electric railway preferred; am a competent electrical, mechanical and steam engineer and can take charge of a lighting as well as railway plant; have had several years' experience constructing and operating electric lines, and know how to handle men for the best interests of all concerned; correspondence solicited. Address L. C. H., care ELECTRICITY.

33 WANTED.—By a stationary engineer with six years' experience position as assistant with some plant; can do lamp repairing and line work in electric station. Address G. S. D., care ELECTRICITY.

34 WANTED.—Position by a mechanical engineer; can do practical work anywhere in the machine shop; well posted on electricity; a first class draughtsman. Address T. C. K., care ELECTRICITY.

35 WANTED.—A works manager offers his services to economic manufacturers of insulated wires; can furnish his own private solid core rubber stocks for any grade of work; mixtures for weatherproof and finishes; designs for all kinds of insulating machines; scientific inexpensive methods of finding costs of manufacture; more than ten years' experience over a wide field; correspondence only with principals. Address "ECONOMICS," care ELECTRICITY.

36 WANTED.—Position as foreman by a man 35 years old; thoroughly familiar with special tools and piece work and well posted on the cost of manufacture of street railway motors and their appliances; will be open for engagement Jan. 1, 1898; can furnish best of references. Address A. J., care ELECTRICITY.

37 WANTED.—Electrician, who is a journalist and telegrapher, desires any good position where ability, energy and temperance are required; best of references. Address ABLE, care ELECTRICITY.

38 WANTED.—Position as chief engineer of a light or power plant; 5 years' experience in the construction and maintenance of alternating and direct current, high speed and Corliss central stations; technically educated; expert lineman and wireman. Address M. H. F., care ELECTRICITY.

39 WANTED.—Position as salesman or manager of any electrical business for American firm in Mex'co; have lived among the Mexicans for years and understand their customs and language; have a thorough scientific education obtained by three years' special study in an accredited school of electrical engineering; references given. Address SPANISH, care ELECTRICITY.

40 WANTED.—Position to make myself generally useful with an electrical engineering party in charge of construction anywhere; have had five years' experience in setting up and maintaining private telephone lines and interior wiring. Address H. W. G., JR., care ELECTRICITY.

Bargains in Electrical Machinery.

Two hundred Dynamos, direct current, alternating and arc; 200 Motors, from 1 to 300 H. P., any voltage; 100 Steam Engines, vertical, horizontal and marine type, high, moderate and slow speed, with or without boilers. Wanted a full description of what you want to buy or sell. WRIGHT, 939 Monadnock Block, Chicago.

METAL TUBING

TO ORDER FOR ELECTRICAL PURPOSES.

Accurately drawn any size or shape up to 1/2 inch, outside diameter.

M. T. HORN

42 and 44 Dey Street, New York.

BANKERS AND BROKERS.**SPENCER TRASK & CO.,**

BANKERS.

Albany, New York.

DEALERS IN LOCAL SECURITIES.

WHITAKER & HODGMAN.

BOND AND STOCK BROKERS.

300 N. FOURTH STREET,
St. Louis, Mo.

Local and Street Railway Securities a Specialty.

A. E. AMES & CO.,

BANKERS AND BROKERS.

10 KING STREET, W.,
Toronto, Canada.

MEMBERS TORONTO STOCK EXCHANGE.

JOHN B. BARBOUR, JR.,

STOCK AND BOND BROKER.

404 TIMES BUILDING,
Pittsburg, Pa.

MEMBER PITTSBURG STOCK EXCHANGE.

HAMBLETON & CO.,

BANKERS.

9 SOUTH STREET,
Baltimore, Md.

Negotiators of Municipal and Corporate Loans.

INVESTMENT SECURITIES OF THE BEST CLASS A SPECIALTY.

Deposit Accounts received. Stocks, Bonds and other securities bought and sold. Private wire to New York, Philadelphia and Washington.

Letters of Credit issued, good in all parts of the world.

Street Railway Securities a Specialty.**W. E. HUTTON & CO.,**

INVESTMENT BANKERS.

13-15 EAST 3D STREET,
Cincinnati, Ohio

Members Cincinnati and New York Stock Exchanges.

GORDON STRATHY & CO.,

STOCK BROKERS.

No. 9 ST. SACRAMENT STREET,
Montreal.

Strictly Commission Business Only.

H. GORDON STRATHY member Montreal Stock Exchange since 1870.

C. FRANKLIN NUGENT & CO.,

BANKERS.

Providence, R. I.

ELECTRICAL ENGINEERING CO.,

311-313 SECOND AVE., SOUTH,

MINNEAPOLIS, MINN.

"Buckeye" Lamps.

POSITIONS VACANT.**Free Advertising.**

Inquiries from employer in want of Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or other assistance from those possessed of technical experience in the various electrical lines, will be inserted in this column Without Charge, whether subscribers or not.

Applicants should enclose the necessary postage to insure the forwarding of letters.

Address all communications to Free Advertising Editor, "Electricity," New York.

9 WANTED.—Chief engineer for light and power station, Pacific Coast. Must be sober, reliable and industrious. Permanent situation for right man. Must be competent mechanic and experienced in the handling and supervision of steam plants, both Corliss and high speed engines, and of arc dynamos, alternators and generators. Salary \$110 per month. Address PACIFIC, care ELECTRICITY.

10 WANTED.—An all-around machinist; married man preferred; one that has had some experience with keeping up street cars, and is willing to work at a moderate salary and prove himself the right man in the right place; must be a sober and energetic gentleman. Address KOKOMO care ELECTRICITY.

MECHANICAL DRAWING

Machine Design; Stationary, Locomotive and Marine Engineering; Electricity; Plumbing; Architecture; Architectural Drawing; Railroad, 31 COURSES Hydraulic & Bridge Engineering; Surveying and Mapping; Sheet Metal Pattern Cutting; Bookkeeping; Shorthand; English Branches; Mining; Metal Prospecting. All who study **GUARANTEED SUCCESS.** Fees Moderate, Advance or Installments. Circular Free; State subject you wish to study. International Correspondence Schools, Box 644, Scranton, Pa.

Typewriter Bargains.

All Standard \$100 Typewriters sold by us (under full guarantee) at \$25 to \$50, little used. Shipped, allowing examination and trial. Send postal for handsome colored Fin-de-Siecle Descriptive Price List of the Standard Machines. All makes exchanged and rented on liberal terms. Desks, one-half cost. Colored Price List of the AMERICAN STANDARD PITMAN SHORT-HAND BOOKS (arranged for self-instruction) sent on application.

Consolidated Typewriter Exchange,
245 Broadway, New York.

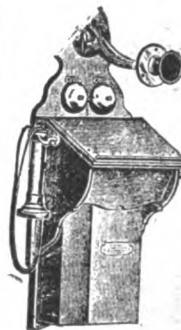
PLATINUM FOR ALL PURPOSES.

Scrap and Native Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave.
NEWARK, N. J.

New York Office, 121 Liberty Street.

Northwestern Telephone Mfg. Co.

Offices: 43 and 44 Loan & Trust Building,
MILWAUKEE, WIS.



Telephones, Switchboards, Magneto Bells, etc. Over 15 years of practical experience in the service with the licensees of the American Bell Telephone Co., a sufficient guarantee of the efficiency of our apparatus. All of our telephones are equipped with a Solid Back Transmitter, identical in principle with that used by the American Bell Telephone Co. for transmitting articulation a distance of 1,000 miles.

Send for prices and mention this paper.

PROFESSIONAL.**A. I. McRAE,**

CONSULTING ELECTRICAL ENGINEER

316 N. Sixth Street, ST. LOUIS.

Estimates, Plans, Specifications, Examinations, Reports, Tests.

PATENTS,

Caveats, Trade-marks, Designs promptly and properly procured in the United States and all foreign countries.

High-class Work. Moderate Fees. Infringement Suits Conducted.

ALEXANDER & DAVIS,
Opposite Patent Office, Washington, D. C.

If You Are Puzzled

Over some problem in Electrical Work reduce your perplexity to the form of a question, send it to **ELECTRICITY**, and have it answered in the "ANSWERS TO CORRESPONDENTS" Department. You can use this blank for convenience. . . .

To the Editor of **ELECTRICITY**.

Sir:

.....

.....

.....

.....

.....

.....

.....

.....

.....

CLASSIFIED INDEX TO ADVERTISEMENTS.

For Alphabetical Index See Page IV.

AMMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N.J.

BANKERS AND BROKERS.

A. E. Ames & Co., 10 King St., W., Toronto, Canada.
John B. Barbour, Jr., Times Building, Pittsburg, Pa.
Hambleton & Co., 9 South St., Baltimore, Md.
W. E. Hutton & Co., 13-15 E. 8d St., Cincinnati, O.
C. Franklin Nugent & Co., Providence R. I.
Gordon Strathy & Co., 9 St. Sacramento St., Montreal, Canada.
Spencer Trask & Co., Albany, N. Y.
Whitaker & Hodgman, 800 N. Fourth St., St. Louis, Mo.

BATTERIES, STORAGE.

Electric Storage Battery Co., Drexel Building, Philadelphia, Pa.

BOILERS.

Abendroth & Boot Mfg. Co., 28 Cliff St., N. Y.

CARBONS, BATTERY.

Electric Appliance Co., 242 Madison St., Chicago.

CIRCUIT BREAKERS.

Ward Leonard Electric Co., Bronxville, N. Y.

CONDENSERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

CONDUIT.

Electric Appliance Co., 242 Madison St., Chicago.
New York Insulated Wire Co., 15 Cortlandt St., New York.

DRILLING MACHINES.

Gould & Eberhardt, Newark, N. J.

DYNAMOS AND MOTORS.

Colburn Electric Mfg. Co., 888 Main St., Fitchburg, Mass.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Siemens & Halske Electric Co., Monadnock Block, Chicago.
Stanley Electric Mfg. Co., Pittsfield, Mass.

EDUCATIONAL

International Correspondence School, Scranton, Pa.
The Correspondence School of Technology, Cleveland, Ohio.

ELECTRICAL MACHINERY.

Ohio Edison Company, 139 Adams Street, Chicago, Ill.

FAN MOTORS.

Electric Appliance Co., 242 Madison St., Chicago, Ill.

FEED WATER HEATERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

FLUSH SWITCHES.

The Electric Protection Co., 1025 Filbert St., Philadelphia, Pa.

GEAR CUTTERS.

Gould & Eberhardt, Newark, N. J.

INSTRUMENTS, TESTING AND RECORDING.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114-120 William St., Newark, N. J.

LAMPS, ARC.

Electric Appliance Co., 242 Madison St., Chicago.

LAMPS, INCANDESCENT.

Beacon Lamp Co., New Brunswick, N. J.
Bryan-Marsh Co., 186 Liberty St., New York.
Buckeye Electric Co., Cleveland, Ohio.
Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.
Orient Electrical Company, Youngstown, O.

LAMPS, MINIATURE INCANDESCENT.

Bryan-Marsh Co., 186 Liberty St., New York.

LATHES.

Gould & Eberhardt, Newark, N. J.

LUBRICATING GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.

MACHINERY ELECTRICAL.

Warren P. Freeman Company, 106-108 Liberty St., New York.

METAL TUBING.

M. T. Horn, 42 Dey St., New York.

MICA.

A. O. Schoonmaker, 158 William St., New York.
Eugene Munsell & Co., 218 Water St., New York.

MOTORS.

See Dynamos and Motors.

PATENT ATTORNEYS.

Alexander & Davis, Washington, D. C.
A. M. Pierce, 80 Church Street, New York.

PLATINUM.

Baker & Co., N. J. Railroad Ave., Newark, N. J.

PORCELAIN INSULATORS AND CLEATS.

Electric Appliance Co., 242 Madison St., Chicago.

RHEOSTATS.

Ward Leonard Electric Co., Bronxville, N. Y.

SEPARATORS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

SHAPERS.

Gould & Eberhardt, Newark, N. J.

STORAGE BATTERIES.

The Electric Storage Battery Co., Drexel Bldg., Philadelphia, Pa.

SUPPLIES, ELECTRIC RAILWAY.

Electric Appliance Co., 242 Madison St., Chicago.

SUPPLIES, GENERAL ELECTRICAL.

Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.

SWITCHBOARDS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

SWITCHES.

A. & J. M. Anderson, 289 A St., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.

TELEPHONES.

American Electric Telephone Co., Kokomo, Ind.
Electric Appliance Co., 242 Madison St., Chicago.
Northwestern Telephone Mfg. Co., Milwaukee, Wis.
Western Telephone Construction Co., 250 South Clinton St. Chicago, Ill.

THEATRE DIMMERS.

Ward Leonard Electric Co., Bronxville, N. Y.

TOOL HOLDERS.

Gould & Eberhardt, Newark, N. J.

TRANSFORMERS.

Fort Wayne Electric Corporation, Fort Wayne Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

TROLLEYS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

TRUCKS.

Graham Equipment Co., Boston, Mass.

VOLTMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WATCHMAN'S TIME DETECTORS.

The American Watchman's Time Detector Co., 234-235 Broadway, New York.

WATTMETERS.

Weston Electrical Instrument Co., 114 William St., Newark, N. J.

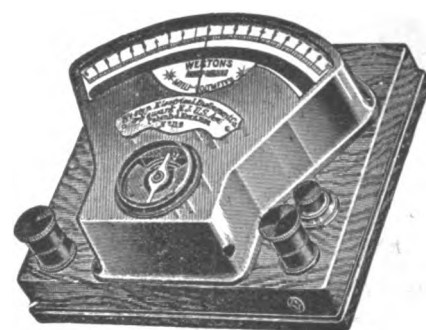
WIRES AND CABLES.

American Electrical Works, Providence, R. I.
Crefeld Electrical Works, 620 Atlantic Ave., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.
India Rubber & Gutta Percha Insulating Co., 15 Cortlandt St. New York.
New York Insulated Wire Co., 15 Cortlandt St., New York.
Okonite Co., 253 Broadway, New York.
Standard Underground Cable Co., Pittsburg, Pa.
W. R. Brixey, 203 Broadway, New York.

WESTON

Standard Portable Direct-Reading

VOLTMETERS, MILLIVOLTMETERS,
VOLTAMMETERS, AMMETERS,
MILLIAMMETERS, OHMMETERS,
GROUND DETECTORS and CIRCUIT
TESTERS,
PORTABLE GALVANOMETERS.



Our Portable Instruments are recognized as **THE STANDARD** the world over. The **SEMI-PORTABLE LABORATORY STANDARDS** are still better. Our **STATION VOLTMETERS** and **AMMETERS** are unsurpassed in point of extreme accuracy and lowest consumption of energy.

Weston Electrical Instrument Company,

114-120 William Street, NEWARK, N. J., U. S. A.

BOOK LIST.

Part II.

- Kapp, Gisbert. Electric Transmission of Energy and its Transformation, Subdivision, and Distribution. A practical handbook. Third edition. 8vo, cl. London, 1890..... 3 00
- and H. D. Wilkinson. Practical Notes for Electrical Students. Vol. I., Laws, Units, and Simple Measuring Instruments. 8vo, cloth. London, 1890..... 2 50
- Latimer, L. H., C. J. Field, and J. W. Howell. Incandescent Electric Lighting. A Practical Description of the Edison System, to which is added the Design and Operation of Incandescent Stations, by C. J. Field; a description of the Edison Electrolytic Meter, by A. E. Kennelly; and a Paper on the Maximum Efficiency of Incandescent Lamps, by T. W. Howell. Illustrated, 16mo, boards. N. Y. 1890..... 50
- Lockwood, T. D. Electricity, Magnetism, and Electric Telegraphy. A Practical Guide and Hand Book of General Information for Electrical Students, Operators, and Inspectors. 8vo, cl. 976 pages, 152 illustrations. N. Y., 1883..... 2 50
- Lodge, Oliver J. Modern Views of Electricity. With illustrations. 12mo, cloth. London, 1889..... 2 00
- Martin, T. C., and J. Wetzler. The Electro-Motor and its Applications. Third edition. With an Appendix on the Development of the Electric Motor since 1888. By Dr. L. Bell. 300 illustrations. 4to, cl. N. Y., 1891..... 3 00
- Maver, Jr., Wm., and Davis, M. M. The Quadruplex. With Chapters on the Dynamo-Electric Machine in Relation to the Quadruplex. The Practical Workings of the Duplex Telegraph Repeaters and the Wheatstone Automatic Telegraph. 63 illustrations. 8vo, cl. N. Y., 1890..... 1 50
- McClure, J. B. Edison and his Inventions, with Full Explanations of the Telephone, Phonograph, Tasometer, Electric Light, and all his Principal Discoveries, etc. 12mo, cl., illustrated. Chicago, 1889..... 1 00
- Meadowcroft, W. H. The A, B, C of Electricity. 36 illustrations. 12mo, cloth. New York, 1890..... 50
- Munro, J., and Prof. A. Jamieson. Pocket Book of Electrical Rules and Tables. For the use of Electricians and Engineers. Eighth edition, revised and enlarged. 32mo, leather. London, 1892..... 2 50
- Murdock, Lient. J. B., U. S. N. Notes on Electricity and Magnetism. Designed as a companion to S. P. Thompson's Elementary Lessons. With illustrations. 16mo, cl. London, 1890..... 60
- Niblett, J. T. Secondary Batteries, being a Description of the Modern Apparatus for the Storage of Electrical Energy. 75 illustrations. 12mo, cloth. London, 1891..... 1 50
- Nipher, Prof. F. E. Theory of Magnetic Measurements. With an appendix on the method of Least Squares. 12mo, cl. N. Y., 1886..... 1 00
- Ohm, Dr. G. T. The Galvanic Circuit Investigated Mathematically. Berlin, 1827. Translated by William Francis, with a preface by the editor, Thos. D. Lockwood, M. Inst. E. E. 16mo, cloth. New York, 1891..... 50
- Planté, Gaston. The Storage of Electrical Energy, and Researches in the Effects Created by Currents Combining Quantity with High Tension. With 89 illustrations. Translated from the French by Paul B. Elwell. 8vo, cl. London, 1887..... 4 00
- Pope, Franklin Leonard. Modern Practice of the Electric Telegraph. A Technical Hand Book for Electricians, Managers, and Operators. 185 illustrations. 14th edition, rewritten and enlarged. 8vo, cloth. New York, 1891..... 1 50
- Siemens, Sir W. Scientific Works. A collection of papers and discussions. Edited by E. T. Bamber, 3 vols. 8vo, cl. London, 1889..... 14 40
- Sloane, T. O'Connor. Electricity Simplified. The Practice and Theory of Electricity, including a Popular Review of the Theory of Electricity, with Analogies and Examples of its Practical Application in every day life. Illustrated. 12mo, cloth. New York, 1891.....
- Electric Toy Making for Amateurs, including Batteries, Magnets, Motors, Miscellaneous Toys and Dynamo Construction. Fully illustrated. 12mo, cloth. New York, 1892..... 1 00
- Smith, Willoughby. The Rise and Extension of Submarine Telegraphy. Illustrated. 8vo, cloth. London, 1891..... 8 40
- Sturgeon, Wm. Scientific Researches, Experimental and Theoretical, in Electricity, Magnetism, Galvanism, Electro-Magnetism and Electro-Chemistry. 4to, cl.....
- Notes on Electricity and Magnetism, Designed as a companion to the above. By J. B. Murdock, U. S. N. 16mo., cl. New York, 1884..... 60
- Dynamo-Electric Machinery. Fourth edition, revised and enlarged. 8vo, cloth. London..... 9 00
- Lectures on the Electro-Magnet. 8vo, cl. Ill. New York, 1891. 1 00
- Thomson, Prof. Elihu. What is Electricity? Illustrated, 8vo, paper. Boston, 1890..... 25
- Sir Wm. Mathematical and Physical Papers. Vol. 3, Electricity, Heat, Electro-Magnetism, with supplementary articles written for the present volume and hitherto unpublished. 8vo, cloth. London, 1890..... 5 50
- Trevert, Edward. Everybody's Handbook of Electricity, with Glossary of Electrical Terms and Tables for Incandescent Wiring. 12mo, paper. 1889..... 25
- Cloth..... 1 00
- Experimental Electricity. Fully illustrated. 12mo cloth. Lynn, 1891..... 1 00
- How to Make Electric Batteries at Home. Illustrated. 12mo, paper, 1890..... 25
- Dynamos and Electric Motors and all about them. 100 illustrations. 12mo, cloth. Lynn, 1891..... 50
- Electricity and its Recent Applications. A Practical Treatise for students and amateurs, with an illustrated Dictionary of electrical terms and phrases. 175 illustrations. 12mo, cloth. 2 00
- Practical Directions for Armature and Field-Magnet Winding. Illustrated. 12mo, cloth. Lynn, Mass. 1892..... 1 60
- Urquhart, J. W. Electric Light; its Production and Use. Fourth edition, re-written, with large additions. Numerous illustrations. 12mo, cloth. London, 1891..... 2 00
- Electric Light Fitting. A Handbook for Working Electrical Engineers. Embodying Practical Notes on Installation Management. With numerous illustrations 12mo, cloth. London, 1891..... 1 00
- Vail Alfred. The American Electro-Magnet Telegraph; with the Reports of Congress and a Description of all Telegraphs known. 8vo., paper. Philadelphia, 1845
- Kennelly, A. E. Evolution of Electric and Magnetic Physics. 8vo. paper New York 1891.....

SENT POSTPAID ON RECEIPT OF PRICE.

ELECTRICITY NEWSPAPER CO.,

136 LIBERTY STREET, NEW YORK.

TWO-PHASE GENERATORS.

Entirely novel in construction and having
 No Moving Wire, No Collector, Slow Speed,
 Better Inherent Regulation, Higher Efficiency,
 than any alternating machine on the market.

SELF-STARTING TWO-PHASE MOTORS,

superior in many ways to direct current motors.

THE BEST TRANSFORMER.

These are the essential elements in our

TWO-PHASE SYSTEM;

which is the only practically completed system in operation to-day for furnishing light and power from the SAME ALTERNATING GENERATOR AND CIRCUIT.

STANLEY ELECTRIC MFG. CO.,
PITTSFIELD, MASS.

CHICAGO, 305 Dearborn Street.

NEW YORK, 39 Cortlandt Street.

BRANCH OFFICES:

BOSTON, Equitable Building.
 ST. LOUIS, MO., Western Electrical Supply Co.

SAN FRANCISCO, 300 California Street.

ANDERSON, S. C.

The Royal Electric Co., Montreal, Can., are exclusive licensees for the manufacture of the S. K. C. System in the Dominion of Canada.

SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA.

—MANUFACTURERS OF—

Direct Current, Multipolar, Slow Speed, External Armature Generators and Motors, especially adapted for direct connection.
 (Type I.)—In sizes from 20 to 2,000 H. P.
 Direct Current, Multipolar, Slow Speed and Medium Speed Internal Armature Generators and Motors adapted for Belting.
 (Type F.)—In sizes from 1 to 300 H. P.
 Direct Current, Bipolar, Medium Speed, Internal Armature Generators and Motors adapted for Belting.
 (Type L. H.)—In sizes from 5 to 180 H. P.
 Direct Boosters Current, absolutely controlled by U. S. Patents granted to Siemens & Halske Electric Company.

SIEMENS' BAND ARC LAMPS FOR DIRECT AND ALTERNATING CURRENT, ELECTRIC MINING LOCOMOTIVES, STEAM LOCOMOTIVES, ETC., ETC.

COMPLETE ELECTRIC RAILWAY EQUIPMENTS UNDER SIEMENS' PATENTS:

SIEMENS' UNDERRUNNING TROLLEYS.

The Siemens Contact Bar is safer than the ordinary trolley, and the overhead construction is less costly. He built his first Electric Railway in 1879. Write for Catalogues and further information to Dr. Ernst Werner von Siemens was the pioneer in Electric Traction.

SIEMENS & HALSKE ELECTRIC CO. OF AMERICA, 98 Jackson St., Chicago.

SALES OFFICES:—NEW YORK, Eastern District, American Surety Building; BOSTON, John Hancock Building; PHILADELPHIA, 581 Chestnut Street; CINCINNATI, Perin Bldg.; DENVER, 608 Boston Block; SALT LAKE CITY, Knottford Hotel Bldg; SAN FRANCISCO, 10 Front St.

People and Profit
Will Come
to You.

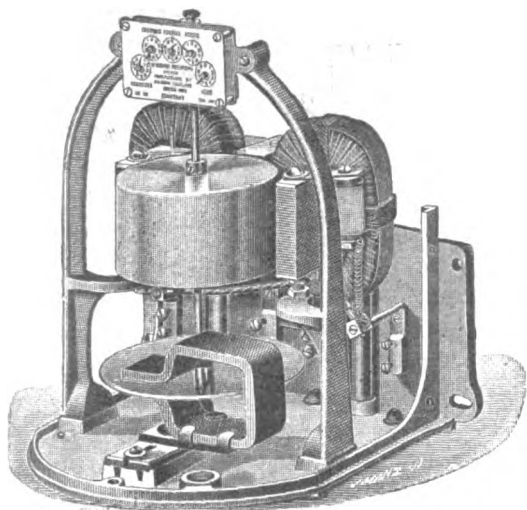
Every click of a wheel in your exhibit, every flash of a light, every feature of excellence or of novelty will be as a welcome word to the hundreds of thousands who will throng Madison Square Garden in May, 1898.

HAVE YOU SPOKEN FOR SPACE?

Electrical Exhibition Company,

MARCUS NATHAN, General Manager.

15 Cortlandt St., New York.



Watt Meters (Schaeffer's Improved) Transformers

NO BRUSHES—
DURABILITY.

NO COMMUTATOR—
RELIABILITY.

NO MOVING WIRE—
ACCURACY.

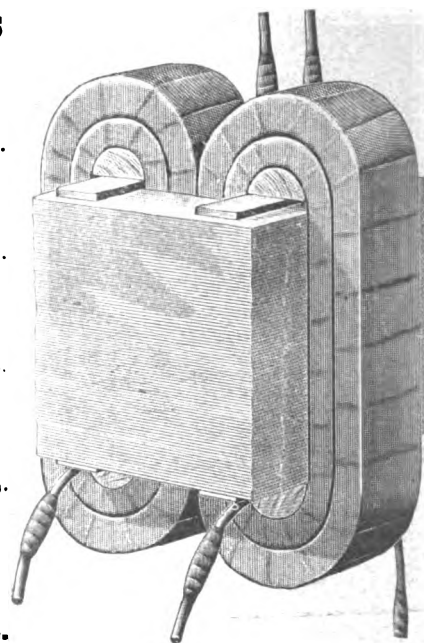
SIMPLICITY—
Even to a 16 c. p. Lamp.

DOUBLE PRIMARY COILS—
HIGH EFFICIENCY.

DOUBLE SECONDARY COILS—
GOOD REGULATION.

GOOD VENTILATION—
SMALL IRON LOSS.

LIGHT WEIGHT—
CONVENIENT TO INSTALL.



DIAMOND ELECTRIC CO.,

Factory: PEORIA, ILL.

OFFICE: 1202 FISHER BUILDING,

CHICAGO, ILL.

FARR TELEPHONE & CONSTRUCTION SUPPLY CO.,

ELLSWORTH BUILDING.

CHICAGO, ILL.

Telephones AND Supplies

AT WHOLESALE PRICES.

SEND FOR CATALOGUE.

Transmitters a Specialty.



HERMAN GIESELER,
Expert Transmitter Maker.
Secured by this company from Berlin,
Germany.

REMOVED

January 1 to Ellsworth Building, where we have larger and much more elegant quarters, thereby enabling us to take better care of our customers.

357 Dearborn Street—90 Plymouth Place.

Digitized by Google

THE BEST BOOKS

FOR

AMATEURS AND ELECTRICAL WORKERS.

ELECTRICAL INSTRUMENT MAKING FOR AMATEURS.—A practical Hand-book with 48 Illustrations. By S. R. Bottone. 12mo cloth. —————

\$0.50

DYNAMO AND MOTOR BUILDING FOR AMATEURS.—A concise hand-book illustrated with working drawings. By C. D. Parkhurst. 12mo cloth. —————

1.00

ELECTRIC TOY MAKING FOR AMATEURS.—A fully illustrated description showing how to construct Batteries, Magnets, Motors, Dynamos and miscellaneous toys. By T. O'Connor Sloane. 12mo cloth. —————

1.00

DOMESTIC ELECTRICAL WORK.—Tells how to wire buildings for Bells, Burglar Alarms, Annunciators, Electric Gas Lighting, etc. Illustrated with 22 diagrams. By W. A. Wittbecker. 12mo paper. —————

\$0.25

PRACTICAL ELECTRICS.—A universal hand-book on every-day electrical matters, including Bells, Carbons, Induction, Intensity and Resistance Coils, Dynamos, Measurements, Microphones, Phonographs, Storage Batteries and Telephones. pp. 135. 12mo cloth. —————

0.75

Any of These Works Sent Postpaid Upon Receipt of Price.

The set of five and one year's subscription to **ELECTRICITY** will be sent for \$5.00.

ELECTRICITY NEWSPAPER CO..

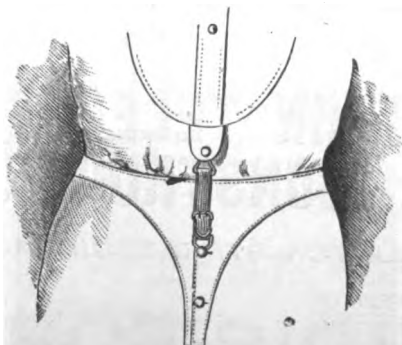
136 LIBERTY ST., NEW YORK.

"Hold-em"

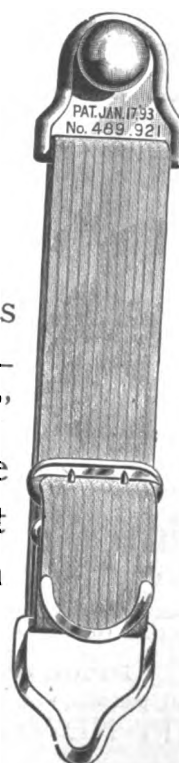
Holds down your shirt.

Holds up your Drawers.

A tab at the lower end of the bosom is a useless method—tapes on the drawers are always broken—both were invented to exasperate the wearer. "Hold-em" makes this useless tab useful; buttons stay on the drawers; the shirt bosom don't wrinkle—the shirt stays down and the drawers 'stay up. Worn on first or second button of drawers. Souls with corporations use the top button—thin people use the next. Comfort and contour dictate. For 15 cents, stamps or silver, we send a "Hold-em" post paid.



Worn as above.



Exact size.
Is handsomely
and neatly made
of colored silk
elastic and nickel
trimmings.

SHAIN COMPANY,

136 Liberty Street, New York.

It is invaluable for the full dress shirt.

TRADE MARK

"Chloride Accumulator"

REGISTERED SEPTEMBER 11, 1904.

The Western Union Telegraph Company
 is installing in its Memphis office
436 Chloride Accumulators
 displacing
5,250 gravity cells.

Atlanta, Washington, New Orleans and eighteen smaller offices are already equipped with Chloride Accumulators, which have effected a great reduction in cost of maintenance and an improvement in the wire service.

THE ELECTRIC STORAGE BATTERY COMPANY,
 Drexel Building, Philadelphia, Pa.

BRANCH OFFICES:

NEW YORK, 20-22 Broad St.
 BOSTON, MASS., 60 State Street.

CHICAGO, ILL., 1643 Marquette Building.
 SAN FRANCISCO, CAL., 222 Market Street.

BALTIMORE, 641 Equitable Building.

C. L. Pratt & Co., Chicago. Havana Cigars.

We give an extra discount to patrons of this paper.

Importers, Jobbers and Manufacturers. Box Trade a Specialty.

82 and 84 Madison Street,
 McVicker Theatre Building.

CANDY CATHARTIC
Cascarets
CURE CONSTIPATION
REGULATE THE LIVER
ALL DRUGGISTS

10¢
 25¢ 50¢

ABSOLUTELY GUARANTEED to cure any case of constipation. Cascarets are the Ideal Laxative, never grip or gripe, but cause easy natural results. Sample and booklet free. Ad. **STERLING REMEDY CO.**, Chicago, Montreal, Can., or New York. 217.

Gordon Primary Cell.



Flow on, electric currents, flow,
 Forever and forever;
 Cells may come and cells may go,
 But the Gordon cell will live forever.

The Gordon Cell will live on its merits, and if you wish to learn
 its merits apply for circular and price list.

GORDON-BURNHAM BATTERY CO.,
 82 to 86 West Broadway, New York.

Modern Examinations of Steam Engineers.

BY W. H. WAKEMAN.

Containing a complete list of 300 questions such as will be asked of any Engineer when taking examination for U. S. Government or State License, all of which are fully answered in the text.

Price \$2.00.

By mail, postpaid, to any part of the world.

ELECTRICITY NEWSPAPER COMPANY,

136 Liberty St., New York.

McIntire's Patent Connectors and Terminals.

FUSED WIRE, FUSED LINKS AND STRIPS.

The C. MCINTIRE CO., 13 and 15 Franklin Street, NEWARK, N. J.

GRAPHITE RESISTANCE.

Graphite resistance in rods, tubes or otherwise. Any resistance wanted—one ohm to one million ohms. Write for particulars.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

THE GOUBERT
FEED WATER
HEATER
 FREE EXHAUST, DURABLE
 EASILY CLEANED

THE STRATTON
SEPARATOR
 DELIVERS
DRY STEAM
 TO YOUR ENGINE.

THE GOUBERT MFG. CO. 14-16 Hudson
 NEW YORK

WESTERN TELEPHONE CONSTRUCTION CO.,

250 S. CLINTON STREET, CHICAGO.

LARGEST MANUFACTURERS OF

Telephones and Appliances,

EXCLUSIVELY, IN THE UNITED STATES.

BOOK LIST.

Part I.

- Allsop, F. B. *Electrical Bell Construction, Treatise on the Construction of Electric Bells, Indicators, and similar apparatus.* 177 Illustrations, 12mo, cloth. London, 1890..... 1 95
- Ayrton, W. E. *Practical Electricity; a Laboratory and Lecture Course for First-year of Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. With numerous Illustrations.* 12mo, cl. London, 1889..... 2 50
- Badt, F. B. *The Dynamo Tenders Hand-Book, with 70 illustrations,* 16mo, cloth, Chicago, 1888..... 1 00
- and Carhart, Prof. H. S. *Derivation of Practical Electrical Units.* 12mo, cloth. Chicago, 1890..... 75
- Bell, Dr. Louis. *The Elements of Practical Electricity.* In press.....
- Benjamin, Park. *The Age of Electricity. From Amber-soul to Telephone.* 12mo, cl. New York, 1888..... 2 00
- Bennet, A. R. *The Telephoning of Great Cities and an Electrical Parcel Exchange System. Two Papers read before the British Association at Cardiff. Revised edition. Numerous diagrams.* London, 1892..... 40
- Blakeley, T. H. *Papers on Alternating Currents of Electricity for the Use of Students and Engineers. Second edition, enlarged.* 12mo, cloth. London, 1889..... 1 50
- Bonney, G. E. *Electro-Plater's Hand Book. A Manual for Amateurs and young Students on Electro-Metallurgy.* 60 illustrations, 12mo, cloth. London, 1891..... 1 20
- Bottoms, S. R. *Electrical Instrument Making for Amateurs. A Practical Handbook, with 48 illustrations. Fourth edition. Enlarged by a chapter on The Telephone.* 12m, clo. London, 1890. Reduced to..... 50
- *The Dynamo, How Made and How Used. A Book for Amateurs. Sixth edition, with additional matter and illustrations.* 1 00
- *Electric Bells and all about them. A Practical Book for Practical Men, with more than 100 illustrations.* 12mo, cl. 50
- *Electro-Motors. How Made and How Used. A Hand-Book for Amateurs and Practical Men. Many Illustrations,* 12mo, cloth. London, 1890. Reduced to..... 50
- *A Guide to Electric Lighting, for the Use of Householders and Amateurs. Ill.* 12mo, cloth. London and N. Y., 1892..... 75
- Cavendish, H. *Electrical researches. Edited by J. Clerk Maxwell.* 8vo, cl. Cambridge, 1879..... 5 00
- Crocker, F. B. and S. S. Wheeler. *The Practical Management of Dynamos and Motors. Illustrated, cl.* N. Y., 1892. In press.....
- Crosby, O. T. and Dr. Louis Bell. *The Electric Railway in Theory and Practice. A complete Treatise on the Construction and Operation of Electric Railways. Illustrated, cloth.* New York, 1892..... 2 50
- Cumming, L. *Electricity treated Experimentally. For the use of Schools and Students. New edition.* 12mo, cloth. London, 1890..... 1 50
- Desmond, Charles. *Electricity for Engineers.* 12mo..... 2 50
- De La Rive, A. *Treatise on Electricity, in Theory and Practice. Translated by C. V. Walker, 3 vols. 8 vo, cloth, London, 1853.*..... 25 00
- Dolbear, Prof. A. E. *The Telephone. An Account of the Phenomena of Electricity, Magnetism and Sound, as Involved in its Action, with directions for making a Speaking Telephone.* 12mo, cl. illustrated. Boston, 1888..... 50
- Electricity in Daily Life. A popular Account of the Science and Application of Electricity to Every-day Uses. With 120 Illustrations.* 8vo, cloth. N. Y., 1890..... 3 00
- Emtage, W. T. A. *An Introduction to the Mathematical Theory of Electricity and Magnetism.* 12mo, cloth. Oxford, 1891. 1 90
- Ewing, Prof. A. J. *The Magnetic Induction in Iron and other Metals.* 159 Illustrations. 8vo, cloth. London, 1891..... 4 00
- Faraday, M. *Experimental Researches in Electricity.* 3 vols. 8vo, cl. London. 1839-55..... 25 00
- Fiske, Lt. Bradley, A., U. S. N. *Electricity in Theory and Practice, or The Elements of Electrical Engineering.* 8th ed. 8vo, cl. 180 illustrations. N. Y., 1891..... 2 50
- Fleming, J. A. *Short Lectures to Electrical Artisans. A course of Experimental Lectures delivered to a Practical Audience.* 8d Ed. 74 illustrations. 12mo, cl. 1890..... 1 50
- Forbes, Prof. Geo. *A Course of Lectures on Electricity. Delivered before the Society of Arts.* 82 illustrations. 12mo, cl. London, 1887..... 1 50
- Gladstone, J. H., and Alfred Tribe. *The Chemistry of the Secondary Batteries of Planté and Faure.* 12mo, cl., illustrated. London, 1888..... 1 00
- Gordon, J. E. H. *A Practical Treatise on Electric Lighting. With 28 full-page plates and many illustrations.* 8vo, cl. London, 1884..... 4 50
- *Four Lectures on Static Electric Induction.* 12mo, cl., ill..... 50
- *A Physical Treatise on Electricity and Magnetism. Second Edition 2 vols., 8vo, cl. Illustrations and plates.* N. Y..... 10 00
- *School Electricity. Sources, Currents, Measurement, Telegraphy, Telephony, Lightning, Electrolysis, Induction, etc., 262 pages, with 140 illustrations,* 12mo, cloth. London, 1886..... 2 00
- Gordon, Mrs. J. E. H. and J. E. H. *Decorative Electricity. With a chapter on Fire Risks. (New and cheaper edition).* London, 2 40
- Gore, G. *The Art of Electro-Metallurgy, including all Known Processes of Electro-Deposition. Fourth edition.* 12mo, cl., ill. 2 00
- Gore, G. *Theory and Practice of Electro Deposition, including every known mode of depositing Metals—Preparing Metal and for Immersion—Inking Moulds and rendering them Conducting.* 12mo, cl. London, 1887..... 80
- *The Art of Electric Separation of Metals, Theoretical and Practical. Fully Illustrated, 8vo, cloth.* London, 1890..... 3 50
- Haskins, C. H. *The Galvanometer and its Uses. A Manual for Electricians and Students.* 4th edition, revised. 12mo, mor., ill. 1 50
- Hedges, K. *Central Station Lighting. Notes on Methods used for the Distribution of Electricity. Illustrated.* 12mo, cl. London, 1889..... 1 25
- Herring, Carl. *Principles of Dynamo Electro Machines; Practical Directions for Designing and Constructing Dynamos. With an Appendix containing several Articles on allied subjects, and a table of equivalents of Units of Measurement. With 59 illustrations.* 12mo, cl. N. Y. 1888..... 2 50
- *Table of Equivalents of Units of Measurements.* 12mo, paper. New York, 1888..... 50
- Hopkinson, Dr. John. *Dynamic Electricity: Its Modern Use and Measurement, chiefly in its Application to Electric Lighting and Telegraphy; including I., some Points in Electric Lighting. II. On the Measurement of Electricity for Commercial Purposes. By J. N. Shoolbred. III. Electric Light Arithmetic. By R. E. Day.* 16mo, boards..... 50
- Hospitalier, E. *Domestic Electricity for Amateurs. Translation from the French. With additions, by C. S. Wharton. With illustrations.* 8vo, cl. London, 1889..... 2 50
- Houston, Prof. E. J. *A Dictionary of Electrical Words, Terms, and Phrases.* 8vo, 750 pages. Illustrated, cloth. N. Y., 1892... 5 00
- Induction Coils. How Made and How Used.* 16mo, boards. N. Y., 1881. 50
- Incandescent Electric Lighting. A practical description of the Edison system, by L. H. Latimer, to which is added a description of the Edison Electrolytic Meter, by A. E. Kennelly, and a paper on the maximum efficiency of Incandescent Lamps, by John W. Howell.* 16mo, boards. New York, 1890..... 2 25
- Jamieson, A. *Elementary Manual of Magnetism and Electricity. Specially arranged for the use of First Year Science and Art Department and other Electrical Students. With numerous illustrated experiments and examination questions.* 2nd edition. 12mo, cloth. London, 1891..... 1 25
- Jenkin, Fleming. *Electricity and Magnetism, with an Appendix on the Telephone and Microphone.* 9th edition. 12mo, cl. London, 1886..... 1 95

SENT POSTPAID ON RECEIPT OF PRICE.

ELECTRICITY NEWSPAPER CO.,
136 LIBERTY STREET, NEW YORK.

Electrical Exposition Headquarters.

THE GERLACH.

(AMERICAN AND EUROPEAN PLAN.)

CHAS. A. GERLACH, Prop.

55 WEST 27th ST., - NEW YORK.

Convenient to Madison Square Garden.

Farr Telephone & Construction Supply Co.,
CHICAGO, ILL.

**Telephones AND
Supplies**

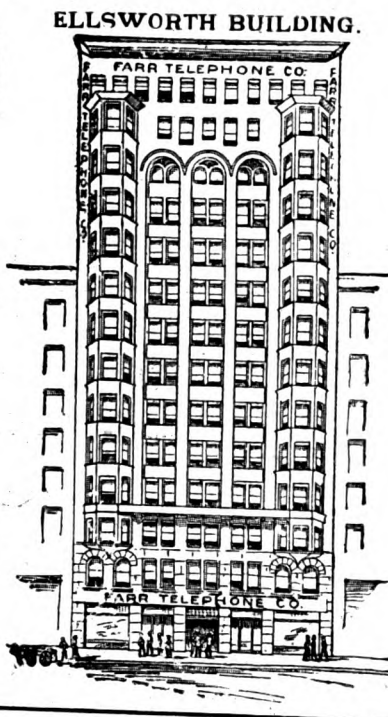
at Wholesale Prices.

TRANSMITTERS A SPECIALTY.

SEND FOR CATALOGUE.

Removed January 1 to Ellsworth Building, where we have larger and much more elegant quarters, enabling us to take better care of our customers.

357 Dearborn Street.
90 Plymouth Place.



**WESTERN TELEPHONE
CONSTRUCTION CO.,**

250 S. OLINTON STREET, CHICAGO.

LARGEST MANUFACTURERS OF

Telephones and Appliances,

EXCLUSIVELY, IN THE UNITED STATES.

Dixon's Pure Flake Graphite

Is a Blessing to Every
Engine Room and Machine Shop.

A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.

Pamphlet and Sample Sent Free.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.



PURE TEMPERED COPPER

CASTINGS, FLAWLESS,
SOUND, AND EXACT DU-
PLICATES OF PATTERNS

E. A. WILLIAMS & SON, 107 PLYMOUTH ST., JERSEY CITY, N. J.

CANDY CATHARTIC
Cascarets
CURE CONSTIPATION
REGULATE THE LIVER
ALL DRUGGISTS

10¢ 25¢ 50¢
ABSOLUTELY GUARANTEED to cure any case of constipation. Cascarets are the Ideal Laxative, never grip or gripe, but cause easy natural results. Sample and booklet free. Ad. STERLING REMEDY CO., Chicago, Montreal, Can., or New York. 211.

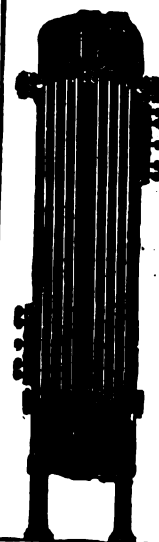
Gordon Primary Cell.



Flow on, electric currents, flow,
Forever and forever;
Cells may come and cells may go,
But the Gordon cell will live forever.

The Gordon Cell will live on its merits, and if you wish to learn its merits apply for circular and price list.

GORDON-BURNHAM BATTERY CO.,
82 to 86 West Broadway, New York.



THE **GOUBERT**
Feed Water Heater

Is the result of the best engineering experience in the utilization of exhaust steam. Meets the requirements of

High Pressure, Free Exhaust, Great Durability
Specially adapted to

CONDENSING ENGINES.

All sizes, 50 to 5,000 HP.

The Stratten Separator

INSURES

Dry Steam.

Extracts all water from steam, no matter how much your boiler may prime or how long your steam pipe. The water is separated by centrifugal force.

An Absolute Safeguard. A Source of Economy.
Manufactured by

THE GOUBERT MFG. CO.

14 and 16 Church St., cor. Cortlandt, New York.



RELIABILITY IS THE FOUNDATION OF SUCCESS.

OUR APPARATUS

is in use in over 400 Prosperous Independent Telephone Exchanges, in the Navy and War Departments, by Railroad Companies, etc., aggregating over **100,000 Telephones.**



ESTABLISHED AT KOKOMO IN 1893.

Medal Awarded, Cotton States and International Exposition, Atlanta, Ga., and Highest Award Tennessee Centennial Exposition, Nashville, Tenn.

AMERICAN, UNIVERSAL AND
EXPRESS SWITCHBOARDS,

The Most Perfect Types in Use.



American Long Distance Series and Bridging Telephones.

American Carbon Lightning Arresters.

American Distributing Boards.

American Repeating Coils, etc., etc.

AMERICAN ELECTRIC TELEPHONE CO.,

LARGEST MANUFACTURERS OF TELEPHONES, SWITCHBOARDS,
AND ACCESSORIES IN THE WORLD

171-173 S. CANAL STREET, - - CHICAGO, ILL.

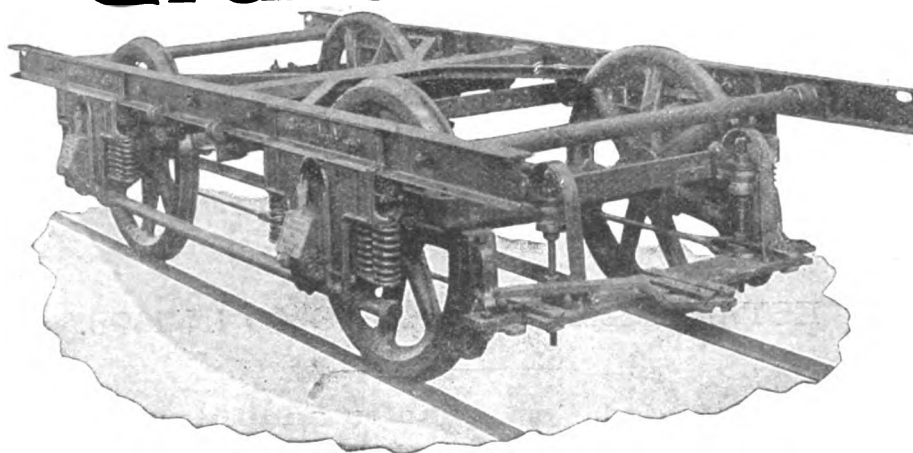
We Guarantee

Workmanship, Material and Efficiency of our Apparatus to be of the HIGHEST GRADE, and agree to defend, at our own expense, any action at law which may be brought against OUR PATRONS on alleged infringement of patents owing to the use of our instruments.

CORRESPONDENCE SOLICITED.

Digitized by Google

Graham Rolled Steel Truck.



If you will look carefully at out you will understand better just how much superior our Brakes are over all others.

Perfection of SIMPLICITY, LIGHTNESS AND STRENGTH. Equipped with Graham's Equalized Brakes, hung on the axle boxes, enabling the motorman to stop the car easier when full than when empty. See cut of truck. The entire frame of truck is supported on Graham's Spring Suspension. The only truck that will not teter or jump. The frame is rolled steel (10 lbs. to the foot), has only twenty $\frac{5}{8}$ inch bolts (no rivets of any kind), all the castings are steel. Frame is braced like a bridge, relieving car body of all strain. Weighs only 8,200 lbs. The easiest on rail joints. The lightest on repairs. The cheapest on fuel. If you are not satisfied with what you have write us.

Graham's Steel Floor Framings

are attracting the attention of all up-to-date railway men. We substitute our Rolled Steel Sill for the wooden sill. It is LIGHTER, STRONGER AND CHEAPER. We bolt the pedestals of the axle boxes to this sill, lowering car floor 8 inches. We can tell you more about this if you will write for circulars.

GRAHAM EQUIPMENT CO.,

Boston, Mass., U. S. A.

Glasgow, Scotland.

C. L. Pratt & Co.,

Chicago.

Havana Cigars.

We give an extra discount to patrons of this paper.

Importers, Jobbers and Manufacturers. Box Trade a Specialty.

82 and 84 Madison Street,

McVicker Theatre Building.

CANDY CATHARTIC
Cascarets
 CURE CONSTIPATION
 REGULATE THE LIVER
 ALL DRUGGISTS
 10¢ 25¢ 50¢
 ABSOLUTELY GUARANTEED to cure any case of constipation. Cascarets are the Ideal Laxative, never grip or gripe, but cause easy natural results. Sample and booklet free. Ad. STERLING REMEDY CO., Chicago, Montreal, Can., or New York. 217.

ANTI-NEURALGIQUE NEURALGIA
 SICK AND NERVOUS HEADACHES
 POSITIVELY CURED IN THIRTY MINUTES.
Anti-Nevralgique
 A purely vegetable compound which seeks the root of trouble and eradicates it; which builds up the nerves, making them strong, which in itself is a guarantee against a return of the trouble.
 At all druggists or sent postpaid upon receipt of One Dollar.
FRENCH CHEMICAL CO.,
 356 Dearborn Street, CHICAGO, ILL.
 This Ha' Never Failed to Cure.

THE GOUBERT
 FEED WATER HEATER
 FREE EXHAUST, DURABLE
 EASILY CLEANED
 THE STRATTON SEPARATOR
 DELIVERS DRY STEAM
 TO YOUR ENGINE.
 THE GOUBERT MFG. CO. 14-16 HURON NEW YORK

Elementary and Complete Courses, TAUGHT
 in Civil, BY
 Mechanical and Electrical Engineering. MAIL.
 THE CORRESPONDENCE SCHOOL OF TECHNOLOGY Cleveland Ohio.

McIntire's Patent Connectors and Terminals.
FUSED WIRE, FUSED LINKS AND STRIPS.

The C. MCINTIRE CO., 13 and 15 Franklin Street, NEWARK, N. J.

Dixon's Pure Flake Graphite

Is a Blessing to Every
 Engine Room and Machine Shop.

A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.

Pamphlet and Sample Sent Free.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.



**WESTERN TELEPHONE
 CONSTRUCTION CO.,**

250 S. CLINTON STREET, CHICAGO.

LARGEST MANUFACTURERS OF

Telephones and Appliances,

EXCLUSIVELY, IN THE UNITED STATES.

SITUATIONS WANTED.**Free Advertising.**

Inquiries from those seeking employment as Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or in other positions requiring technical experience or intimate acquaintance with the electrical trade, will be inserted in this column Without Charge. Each advertiser is invited to repeat his advertisement in case the first one produces no results.

It is the desire of the management of this paper to bring the unemployed and the employer together to their mutual benefit, and to this end they invite the former to make use of this column without charge. No advertisement exceeding five lines (about 55 words) will be inserted, but advertisers may write fully of their qualifications and these letters will be kept on file for future reference in filling vacancies which may occur.

Applicants should write clearly and distinctly and enclose postage to insure attention. Address all communications to Free Advertising Editor, "Electricity," New York.

31 WANTED.—Position by an electrician; age 25, married; over seven years' practical experience in light and power work, installing generators and motors, also all systems of arc and incandescent wiring and line work. Address A. K., care ELECTRICITY.

32 WANTED.—Position as manager or superintendent; interurban electric railway preferred; am a competent electrical, mechanical and steam engineer and can take charge of a lighting as well as railway plant; have had several years' experience constructing and operating electric lines, and know how to handle men for the best interests of all concerned; correspondence solicited. Address L. C. H., care ELECTRICITY.

33 WANTED.—By a stationary engineer with six years' experience position as assistant with some plant; can do lamp repairing and line work in electric station. Address G. S. D., care ELECTRICITY.

34 WANTED.—Position by a mechanical engineer; can do practical work anywhere in the machine shop; well posted on electricity; a first class draughtsman. Address T. O. K., care ELECTRICITY.

35 WANTED.—A works manager offers his services to economic manufacturers of insulated wires; can furnish his own private solid core rubber stocks for any grade of work; mixtures for weatherproof and finishes; designs for all kinds of insulating machines; scientific inexpensive methods of finding costs of manufacture; more than ten years' experience over a wide field; correspondence only with principals. Address "ECONOMICS," care ELECTRICITY.

36 WANTED.—Position as foreman by a man 35 years old; thoroughly familiar with special tools and piece work and well posted on the cost of manufacture of street railway motors and their appliances; will be open for engagement Jan. 1, 1896; can furnish best of references. Address A. J., care ELECTRICITY.

37 WANTED.—Electrician, who is a journalist and telegrapher, desires any good position where ability, energy and temperance are required; best of references. Address ABLE, care ELECTRICITY.

38 WANTED.—Position as chief engineer of a light or power plant; 5 years' experience in the construction and maintenance of alternating and direct current, high speed and Corliss central stations; technically educated; expert lineman and wireman. Address M. H. F., care ELECTRICITY.

39 WANTED.—Position as manager of any electrical business in Mexico; can speak Spanish and has a thorough scientific education obtained by four years' special study in a well known school of electrical engineering; references furnished. Address SPANISH, care ELECTRICITY.

40 WANTED.—Position to make myself generally useful with an electrical engineering party in charge of construction anywhere; have had five years' experience in setting up and maintaining private telephone lines and interior wiring. Address H. W. G., JR., care ELECTRICITY.

41 WANTED.—A college graduate in electrical engineering, with good shop experience, also central station installation and operation, wishes to change present position; best of references and good reason for change given; correspondence solicited. Address LEHIGH, care ELECTRICITY.

WRITE FOR PRICES.
ORIENT ELECTRICAL CO.
YOUNGSTOWN, OHIO.
MAKERS
INCANDESCENT
LAMPS.

PLATINUM FOR ALL PURPOSES
Scrap and Native
Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave.
NEWARK, N. J.
New York Office, 121 Liberty Street.

BANKERS AND BROKERS.**SPENCER TRASK & CO.,****BANKERS.**

Albany, New York.

DEALERS IN LOCAL SECURITIES.

WHITAKER & HODGMAN.**BOND AND STOCK BROKERS.**300 N. FOURTH STREET,
St. Louis, Mo.

Local and Street Railway Securities a Specialty.

A. E. AMES & CO.,**BANKERS AND BROKERS.**

10 KING STREET, W.,

Toronto, Canada.

MEMBERS TORONTO STOCK EXCHANGE.

JOHN B. BARBOUR, JR.,**STOCK AND BOND BROKER.**

404 TIMES BUILDING,

Pittsburg, Pa.

MEMBER PITTSBURG STOCK EXCHANGE.

HAMBLETON & CO.,**BANKERS.**

9 SOUTH STREET,

Baltimore, Md.

Negotiators of Municipal and Corporate Loans.

INVESTMENT SECURITIES OF THE BEST CLASS A SPECIALTY.

Deposit Accounts received. Stocks, Bonds and other securities bought and sold. Private wire to New York, Philadelphia and Washington.
Letters of Credit issued, good in all parts of the world.

Street Railway Securities a Specialty.

W. E. HUTTON & CO.,**INVESTMENT BANKERS.**

13-15 EAST 3D STREET.

Cincinnati, Ohio

Members Cincinnati and New York Stock Exchanges.

GORDON STRATHY & CO.,**STOCK BROKERS.**

No. 9 ST. SACRAMENT STREET,

Montreal.

Strictly Commission Business Only.

H. GORDON STRATHY member Montreal Stock Exchange since 1870.

C. FRANKLIN NUGENT & CO.,**BANKERS.**

Providence, R. I.

ELECTRICAL ENGINEERING CO.,

311-313 SECOND AVE., SOUTH,

MINNEAPOLIS, MINN.

"Buckeye" Lamps.

POSITIONS VACANT.**Free Advertising.**

Inquiries from employers in want of Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or other assistance from those possessed of technical experience in the various electrical lines, will be inserted in this column Without Charge, whether subscribers or not.

Applicants should enclose the necessary postage to insure the forwarding of letters.

Address all communications to Free Advertising Editor, "Electricity," New York.

10 WANTED.—An all-around machinist; married man preferred; one that has had some experience with keeping up street cars, and is willing to work at a moderate salary and prove himself the right man in the right place; must be a sober and energetic gentleman. Address

KOKOMO care ELECTRICITY.

Typewriter Bargains.

All Standard \$100 Typewriters sold by us (under full guarantee) at \$25 to \$50, little used. Shipped, allowing examination and trial. Send postal for handsome colored Fin-de-Siècle Descriptive Price List of the Standard Machines. All makes exchanged and rented on liberal terms. Desks, one-half cost. Colored Price List of the AMERICAN STANDARD PITMAN SHORT-HAND BOOKS (arranged for self-instruction) sent on application.

Consolidated Typewriter Exchange,
345 Broadway, New York.

Two Good Books that You may Prove Useful to You**Speeches and Speech Making**

BY JUDGE J. W. DONOVAN.

This book upon its appearance obtained an immediate and wide-spread popularity. And that is natural, for it is of practical interest and value to every man who has or hopes for any prominence in his community. It contains nearly 300 pages, giving practical hints and helps, both as to preparing and delivering speeches, examples of speeches, for the many different occasions on which we are all apt to be called upon for speeches, when we have not time to prepare and must depend upon the preparation of times past. This book will aid one to prepare for such occasions. The sooner a man begins to prepare the better, for he cannot become a good public speaker at a bound, but public speakers are made as well as born.

Handsomely bound in Cloth, \$1.50 delivered.

Model Banquet Speeches,

BY FAMOUS BANQUET SPEAKERS.

Here we offer you the finest collection of after-dinner speeches ever gathered together in one book, for they are not a collection of the utterances of one man, but are the best efforts of many men famous at the banquet table, such as Thomas A. Hendricks, Senator Vilas, James G. Jenkins, Geo. W. Wacker, Thomas F. Bayard, Gen. J. C. Black, Rev. Wm. E. Park, Dr. Hirsch, John B. Green, Henry Wollman, Joseph C. Hendrix, Judge Grosscup, Senator Foraker, Chauncey M. Depew; and many others "of infinite jest, of most excellent fancy and flashes of merriment that were wont to set the tables on a roar." The speeches here given cover an infinite variety of subjects and occasions—banquets, business men's banquets, political banquets, occasional celebrations, and all kinds and conditions of society gatherings. The after-dinner speaker, or one who would be such, wants this book.

Handsomely bound in Cloth, \$1.50 delivered.

Address
ELECTRICITY NEWSPAPER CO.,
136 Liberty St., New York.

INVESTORS

Need to learn of the value and permanency of the investments they make.

ELECTRICITY

is the only publication fearless enough to present information which will enable investors to discriminate between

SAFE and UNSAFE

The Attitude of the Trust

"Didn't do a thing to us" but double our business last year.
The increase keeps up—we would be glad to have it doubled
again—we are getting ready for it. Best lamps, lowest prices.

17c., bbl. lots.

THE WARREN ELECTRIC & SPECIALTY CO., WARREN, OHIO,
Manufacturers High Grade Anti-Trust Incandescent Lamps.

BUCKEYE Incandescent LAMPS.

—Quality Unequalled.—

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio.
Monadnock Building, Chicago.

CLASSIFIED INDEX TO ADVERTISEMENTS.

For Alphabetical Index See Page IV.

AMMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N.J.

BANKERS AND BROKERS.

A. E. Ames & Co., 10 King St. W., Toronto, Canada.
John B. Barbour, Jr., Times Building, Pittsburg, Pa.
Hambleton & Co., 9 South St., Baltimore, Md.
W. E. Hutton & Co., 13-15 E. 3d St., Cincinnati, O.
C. Franklin Nugent & Co., Providence R. I.
Gordon Strathy & Co., 9 St. Sacrament St., Montreal, Canada.
Spencer Trask & Co., Albany, N. Y.
Whitaker & Hodgman, 800 N. Fourth St., St. Louis, Mo.

BATTERIES, STORAGE.

Electric Storage Battery Co., Drexel Building, Philadelphia, Pa.

BOILERS.

Abendroth & Root Mfg. Co., 28 Cliff St., N. Y.

CARBONS, BATTERY.

Electric Appliance Co., 242 Madison St., Chicago.

CIRCUIT BREAKERS.

Ward Leonard Electric Co., Bronxville, N. Y.

CONDENSERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

CONDUIT.

Electric Appliance Co., 242 Madison St., Chicago.
New York Insulated Wire Co., 15 Cortlandt St., New York.

CONSULTING ELECTRICAL ENGINEERS.

Forre Bain, Suite 1637-59 Monadnock Bldg., Chicago.
A. L. McRae, 316 N. Sixth street, St. Louis.

DRILLING MACHINES.

Gould & Eberhardt, Newark, N. J.

DYNAMOS AND MOTORS.

Colburn Electric Mfg. Co., 888 Main St., Fitchburg, Mass.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Stemens & Halske Electric Co., Monadnock Block, Chicago.
Stanley Electric Mfg. Co., Pittsfield, Mass.

EDUCATIONAL.

International Correspondence School, Scranton, Pa.
The Correspondence School of Technology, Cleveland, Ohio.

ELECTRICAL MACHINERY.

Chicago Edison Company, 139 Adams Street, Chicago, Ill.

FAN MOTORS.

Electric Appliance Co., 242 Madison St., Chicago, Ill.

FEED WATER HEATERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

FLUSH SWITCHES.

The Electric Protection Co., 1025 Filbert st., Philadelphia, Pa.

GEAR CUTTERS.

Gould & Eberhardt, Newark, N. J.

INSTRUMENTS, TESTING AND RECORDING.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114-120 William St., Newark, N. J.

LAMPS, ARC.

Electric Appliance Co., 242 Madison St., Chicago.

LAMPS, INCANDESCENT.

Beacon Lamp Co., New Brunswick, N. J.
Bryan-Marsh Co., 186 Liberty St., New York.
Buckeye Electric Co., Cleveland, Ohio.
Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.
Orient Electrical Company, Youngstown, O.

LAMPS, MINIATURE INCANDESCENT.

Bryan-Marsh Co., 186 Liberty st., New York.

LATHES.

Gould & Eberhardt, Newark, N. J.

LUBRICATING GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.

MACHINERY ELECTRICAL.

Warren P. Freeman Company, 106-108 Liberty St., New York.

METAL TUBING.

M. T. Horn, 42 Dey St., New York.

MICA.

A. O. Schoonmaker, 158 William St., New York.
Eugene Munsell & Co., 218 Water St., New York.

MOTORS.

See Dynamos and Motors.

PATENT ATTORNEYS.

Alexander & Davis, Washington, D. C.
A. M. Pierce, 80 Church street, New York.

PLATINUM.

Baker & Co., N. J. Railroad Ave., Newark, N. J.

PORCELAIN INSULATORS AND CLEATS.

Electric Appliance Co., 242 Madison St., Chicago.

RHEOSTATS.

Ward Leonard Electric Co., Bronxville, N. Y.

SEPARATORS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

SHAPERS.

Gould & Eberhardt, Newark, N. J.

STORAGE BATTERIES.

The Electric Storage Battery Co., Drexel Bldg, Philadelphia, Pa.

SUPPLIES, ELECTRIC RAILWAY.

Electric Appliance Co., 242 Madison St., Chicago.

SUPPLIES, GENERAL ELECTRICAL.

Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.

SWITCHBOARDS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

SWITCHES.

A. & J. M. Anderson, 289 A St., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.

TELEPHONES.

American Electric Telephone Co., Kokomo, Ind.
Electric Appliance Co., 242 Madison St., Chicago.
Farr Telephone & Construction Supply Co., Chicago, Ill.
Northwestern Telephone Mfg. Co., Milwaukee, Wis.
Western Telephone Construction Co., 250 South Clinton St. Chicago, Ill.

THEATRE DIMMERS.

Ward Leonard Electric Co., Bronxville, N. Y.

TOOL HOLDERS.

Gould & Eberhardt, Newark, N. J.

TRANSFORMERS.

Fort Wayne Electric Corporation, Fort Wayne Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

TROLLEYS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

TRUCKS.

Graham Equipment Co., Boston, Mass.

VOLTMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WATCHMAN'S TIME DETECTORS.

The American Watchman's Time Detector Co., 284-285 Broadway, New York.

WATTMETERS.

Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WIRES AND CABLES.

American Electrical Works, Providence, R. I.
Crefeld Electrical Works, 620 Atlantic Ave., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.
India Rubber & Gutta Percha Insulating Co., 15 Cortlandt St. New York.
New York Insulated Wire Co., 15 Cortlandt St., New York.
Okonite Co., 253 Broadway, New York.
Standard Underground Cable Co., Pittsburg, Pa.
W. R. Brixey, 203 Broadway, New York.

WRITING MACHINE.

Tower, Dawson & Co., 306 and 303 Broadway, New York.

SITUATIONS WANTED.**Free Advertising.**

Inquiries from those seeking employment as Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or in other positions requiring technical experience or intimate acquaintance with the electrical trade, will be inserted in this column Without Charge. Each advertiser is invited to repeat his advertisement in case the first one produces no results.

It is the desire of the management of this paper to bring the unemployed and the employer together to their mutual benefit, and to this end they invite the former to make use of this column without charge. No advertisement exceeding five lines (about 55 words) will be inserted, but advertisers may write fully of their qualifications and these letters will be kept on file for future reference in filling vacancies which may occur.

Applicants should write clearly and distinctly and enclose postage to insure attention. Address all communications to Free Advertising Editor, "Electricity," New York.

38 WANTED.—Position as chief engineer of a light or power plant; 5 years' experience in the construction and maintenance of alternating and direct current, high speed and Corliss central stations; technically educated; expert lineman and wireman. Address M. H. F., care ELECTRICITY.

39 WANTED.—Position as manager of any electrical business in Mexico; can speak Spanish and has a thorough scientific education obtained by four years' special study in a well known school of electrical engineering; references furnished. Address SPANISH, care ELECTRICITY.

40 WANTED.—Position to make myself generally useful with an electrical engineering party in charge of construction anywhere; have had five years' experience in setting up and maintaining private telephone lines and interior wiring. Address H. W. G., JR., care ELECTRICITY.

41 WANTED.—A college graduate in electrical engineering, with good shop experience, also central station installation and operation, wishes to change present position; best of references and good reason for change given; correspondence solicited. Address LEHIGH, care ELECTRICITY.

42 WANTED.—Position as foreman or inspector of telephone or electric light plant; have had 12 years' experience; can do practical work anywhere; strictly temperate; best of references. Address W. C., care ELECTRICITY.

43 WANTED.—Position by a young man (22) with two years' training at a technical school and considerable practical experience; preferably one with a consulting engineer or electric lighting company. Address H., care ELECTRICITY.

44 WANTED.—Position by a central station manager; expert in all practical details; ten years' experience in finances; will operate plant for part salary, balance based on results; large plants as references. Address STOCKHOLDER, care ELECTRICITY.

45 WANTED.—Position where I can learn electrical engineering; no technical knowledge and very little experience; will go anywhere. Address W. G. M., Lock Box 28, Ninety Six, S. C.

46 WANTED.—Position as superintendent of plant by an electrical; seven years' practical experience in light and power, both alternating and direct current; excellent reference. Address G. K., care ELECTRICITY.

47 WANTED.—Position by an engineer who has had about ten years' experience in lighting and street railway plants; also understands ice machines; at present employed; best of reference; married; will go to any section of the country. Address D. C. W., care ELECTRICITY.

48 WANTED.—Position as superintendent or assistant superintendent of an electric lighting plant; have had 9 years' practical experience in electric lighting in all its branches; am a machinist by trade; can furnish the very best of references. Address L. E., care ELECTRICITY.

49 WANTED.—Position by electrician as superintendent or manager of a telephone exchange; 10 years' experience; best of references; married; strictly temperate. Address H. M., 617 Front st., Fort Madison, Ia.

PLATINUM FOR ALL PURPOSES
Scrap and Native
Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave.
NEWARK, N. J.
New York Office, 121 Liberty Street.

ELECTRICITY wants subscription and advertising agents in every city and town. Big commissions.

BANKERS AND BROKERS.**SPENCER TRASK & CO.,****BANKERS.**

Albany, New York.

DEALERS IN LOCAL SECURITIES.

WHITAKER & HODGMAN.
BOND AND STOCK BROKERS.300 N. FOURTH STREET,
St. Louis, Mo.

Local and Street Railway Securities a Specialty.

A. E. AMES & CO.,
BANKERS AND BROKERS.10 KING STREET, W.,
Toronto, Canada.

MEMBERS TORONTO STOCK EXCHANGE.

JOHN B. BARBOUR, JR.,
STOCK AND BOND BROKER.404 TIMES BUILDING,
Pittsburg, Pa.

MEMBER PITTSBURG STOCK EXCHANGE.

HAMBLETON & CO.,
BANKERS.9 SOUTH STREET,
Baltimore, Md.

Negotiators of Municipal and Corporate Loans.

INVESTMENT SECURITIES OF THE BEST CLASS A SPECIALTY.
Deposit Accounts received. Stocks, Bonds and other securities bought and sold. Private wire to New York, Philadelphia and Washington.
Letters of Credit issued, good in all parts of the world.**Street Railway Securities a Specialty.****W. E. HUTTON & CO.,****INVESTMENT BANKERS.**13-15 EAST 3D STREET,
Cincinnati, Ohio

Members Cincinnati and New York Stock Exchanges.

GORDON STRATHY & CO.,
STOCK BROKERS.No. 9 ST. SACRAMENT STREET,
Montreal.

Strictly Commission Business Only.

H. GORDON STRATHY member Montreal Stock Exchange since 1870.

C. FRANKLIN NUGENT & CO.,
BANKERS.

Providence, R. I.

Enterprising Young Electrical Engineers

who desire to obtain a year's subscription to "Electricity" free of charge can do so by securing two new subscribers. Published weekly. \$2.50 per year. Address

ELECTRICITY NEWSPAPER CO.,
136 Liberty St., New York

POSITIONS VACANT.**Free Advertising.**

Inquiries from employers in want of Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or other assistance from those possessed of technical experience in the various electrical lines, will be inserted in this column Without Charge, whether subscribers or not.

Applicants should enclose the necessary postage to insure the forwarding of letters.

Address all communications to Free Advertising Editor, "Electricity," New York.

WANTED By Old Established House—High Grade Man or Woman, of good Church standing, to act as manager here and do office work and correspondence at their home. Business already built up and established here, Salary \$500. Enclose self-addressed stamped envelope for our terms to A. P. Elder, General Manager, 189 Michigan ave., Chicago.

Blue Print Paper

for making duplicate copies of drawings.
Finest quality. Lowest price.

WE MANUFACTURE

Drawing Instruments

of the finest grade. Send for Catalogue D. Drawing paper and supplies. Cameras and photo materials. Bon Ton Cameras 8 1/2 x 8 1/2 \$5, delivered at any express office. Finest \$5 Camera, Catalogue P.

THOS. H. McCALLIN & CO.,

1080 Arch Street, Philadelphia.

Two Good Books that may Prove Useful to You**Speeches and Speech Making**

BY JUDGE J. W. DONOVAN.

This book upon its appearance obtained an immediate and wide-spread popularity. And that is natural, for it is of practical interest and value to every man who has or hopes for any prominence in his community. It contains nearly 300 pages, giving practical hints and helps both as to preparing and delivering speeches; examples of speeches for the many different occasions on which we are all apt to be called upon for speeches, when we have not time to prepare and must depend upon the preparation of times past. This book will aid one to prepare for such occasions. The sooner a man begins to prepare the better, for he cannot become a good public speaker at a bound, but public speakers are made as well as born.

Handsomely bound in Cloth. \$1.50 delivered.

Model Banquet Speeches,

BY FAMOUS BANQUET SPEAKERS.

Here we offer you the finest collection of after-dinner speeches ever gathered together in one book, for they are not a collection of the utterances of one man, but are the best efforts of many men famous at the banquet board, such as Thomas A. Hendricks, Senator Vilas, James G. Jenkins, Geo. W. Wakefield, Thomas F. Bayard, Gen. J. C. Black, Rev. Wm. E. Park, Dr. Hirsch, John B. Green, Henry Wollman, Joseph C. Hendrix, Judge Grosscup, Senator Foraker, Chauncey M. Depew, and many others "of infinite jest, of most excellent fancy and flashes of merriment that were wont to set the tables on a roar." The speeches here given cover an infinite variety of subjects and occasions—bar banquets, business men's banquets, political banquets, occasional celebrations, and all kinds and conditions of society gatherings. The after-dinner speaker, or one who would be such, wants this book.

Handsomely bound in Cloth. \$1.50 delivered.
Address
ELECTRICITY NEWSPAPER CO.,
136 Liberty St., New York.

INVESTORS

Need to learn of the value and permanency of the investments they make.

ELECTRICITY

is the only publication fearless enough to present information which will enable investors to discriminate between

SAFE and UNSAFE



DON'T spend all your earnings for coal or on car and track repairs. Show you are up-to-date by running up-to-date equipment. Our trucks and steel-framed cars will help you earn dividends. Our idea of rolling stock is to make it light and strong and equip it with our Equalized Brakes, which avoids flat wheels and accidents. Write us when you are in the market for NEW IDEAS.

GRAHAM EQUIPMENT CO.

ANY ELECTRICAL BOOK Published in America or Europe will be sent postpaid on receipt of price by **ELECTRICITY NEWSPAPER CO., 136 Liberty Street, N. Y.**

CLASSIFIED INDEX TO ADVERTISEMENTS.

For Alphabetical Index See Page IV.

AMMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N.J.
Cherry Electric Works, 27 Third Avenue, New York.

BANKERS AND BROKERS.

A. E. Ames & Co., 10 King St., W., Toronto, Canada.
John B. Barbour, Jr., Times Building, Pittsburg, Pa.
Hambleton & Co., 9 South St., Baltimore, Md.
W. E. Hutton & Co., 13-15 E. 8d St., Cincinnati, O.
C. Franklin Nugent & Co., Providence, R. I.
Gordon Strathy & Co., 9 St. Sacramento St., Montreal, Canada.
Spencer Trask & Co., Albany, N. Y.
Whitaker & Hodgman, 800 N. Fourth St., St. Louis, Mo.

BATTERIES, STORAGE.

Electric Storage Battery Co., Drexel Building, Philadelphia, Pa.

BOILERS.

Abendroth & Root Mfg. Co., 28 Cliff St., N. Y.

CARBONS, BATTERY.

Electric Appliance Co., 242 Madison St., Chicago.

CIRCUIT BREAKERS.

Ward Leonard Electric Co., Bronxville, N. Y.

COPPER.

Eureka Tempered Copper Company, North East, Pa.
E. A. Williams & Son, 107 Plymouth St., Jersey City, N. J.

CONDENSERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

CONDUIT.

Electric Appliance Co., 242 Madison St., Chicago.
New York Insulated Wire Co., 15 Cortlandt St., New York.

CONSULTING ELECTRICAL ENGINEERS.

Foree Bain, Suite 1637-39 Monadnock Bldg., Chicago.
A. L. McRae, 316 N. Sixth Street, St. Louis.
The Frank B. Rae Engineering Co., Chicago, Ill.

DRILLING MACHINES.

Gould & Eberhardt, Newark, N. J.

DYNAMOS AND MOTORS.

Colburn Electric Mfg. Co., 888 Main St., Fitchburg, Mass.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

EDUCATIONAL.

International Correspondence School, Scranton, Pa.
The Correspondence School of Technology, Cleveland, Ohio.

ELECTRICAL MACHINERY.

Chicago Edison Company, 189 Adams Street, Chicago, Ill.

FAN MOTORS.

Electric Appliance Co., 242 Madison St., Chicago, Ill.

FEED WATER HEATERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

FLUSH SWITCHES.

The Electric Protection Co., 1026 Filbert St., Philadelphia, Pa.

GEAR CUTTERS.

Gould & Eberhardt, Newark, N. J.

INSTRUMENTS, TESTING AND RECORDING.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114-120 William St., Newark, N. J.

LAMPS, ABC.

Electric Appliance Co., 242 Madison St., Chicago.

LAMPS, INCANDESCENT.

Beacon Lamp Co., New Brunswick, N. J.
Bryan-Marsh Co., 186 Liberty St., New York.
Buckeye Electric Co., Cleveland, Ohio.
Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.
Orient Electrical Company, Youngstown, O.
Warren Electric & Specialty Co., Warren, O.
Thomas A. Edison, Jr., 96 Broadway, New York.

LAMPS, MINIATURE INCANDESCENT.

Bryan-Marsh Co., 186 Liberty St., New York.

LATHES.

Gould & Eberhardt, Newark, N. J.

LUBRICATING GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.

MACHINERY, ELECTRICAL.

Warren P. Freeman Company, 106-108 Liberty St., New York.

MOTORS.

See Dynamos and Motors.

PATENT ATTORNEYS.

Davis & Davis, Washington, D. C.
Charles J. Kintner, 45 Broadway, New York.

PLATINUM.

Baker & Co., N. J. Railroad Ave., Newark, N. J.

PORCELAIN INSULATORS AND CLEATS.

Electric Appliance Co., 242 Madison St., Chicago.

RHEOSTATS.

Ward Leonard Electric Co., Bronxville, N. Y.

SEPARATORS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

SHAPERS.

Gould & Eberhardt, Newark, N. J.

STORAGE BATTERIES

The Electric Storage Battery Co., Drexel Bldg., Philadelphia

SUPPLIES, ELECTRIC RAILWAY.

Electric Appliance Co., 242 Madison St., Chicago.

SUPPLIES, GENERAL ELECTRICAL.

Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.

SWITCHBOARDS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

SWITCHES.

A. & J. M. Anderson, 289 A St., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago

TELEPHONES.

American Electric Telephone Co., Kokomo, Ind.
Electric Appliance Co., 242 Madison St., Chicago.
Farr Telephone & Construction Supply Co., Chicago, Ill.
Northwestern Telephone Mfg. Co., Milwaukee, Wis.
Western Telephone Construction Co., 250 South Clinton St., Chicago, Ill.
DeVeau & Co., 27 Rose St., New York.

THEATRE DIMMERS.

Ward Leonard Electric Co., Bronxville, N. Y.

TOOL HOLDERS.

Gould & Eberhardt, Newark, N. J.

TRANSFORMERS.

Fort Wayne Electric Corporation, Fort Wayne Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

TROLLEYS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

TRUCKS.

Graham Equipment Co., Boston, Mass.

VOLTMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WATCHMAN'S TIME DETECTORS.

The American Watchman's Time Detector Co., 224-225 Broadway, New York.

WATTMETERS.

Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WIRES AND CABLES.

American Electrical Works, Providence, R. I.
Orefeld Electrical Works, 620 Atlantic Ave., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.
India Rubber & Gutta Percha Insulating Co., 15 Cortlandt St., New York.
New York Insulated Wire Co., 15 Cortlandt St., New York.
Okonite Co., 231 Broadway, New York.
Standard Underground Cable Co., Pittsburg, Pa.
W. R. Brizley, 308 Broadway, New York.

SITUATIONS WANTED.**Free Advertising.**

Inquiries from those seeking employment as Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or in other positions requiring technical experience or intimate acquaintance with the electrical trade, will be inserted in this column without charge. Each advertiser is invited to repeat his advertisement in case the first one produces no results.

It is the desire of the management of this paper to bring the unemployed and the employer together to their mutual benefit, and to this end they invite the former to make use of this column without charge. No advertisement exceeding five lines (about 55 words) will be inserted, but advertisers may write fully of their qualifications and these letters will be kept on file for future reference in filling vacancies which may occur.

Applicants should write clearly and distinctly and enclose postage to insure attention.

Address all communications to Free Advertising Editor, "Electricity," New York.

32 WANTED.—Position as manager or superintendent; Interurban electric railway preferred; am a competent electrical, mechanical and steam engineer and can take charge of a lighting as well as railway plant; have had several years' experience constructing and operating electric lines, and know how to handle men for the best interests of all concerned; correspondence solicited. Address L. C. H., care ELECTRICITY.

33 WANTED.—By a stationary engineer with six years' experience position as assistant with some plant; can do lamp repairing and line work in electric station. Address G. S. D., care ELECTRICITY.

34 WANTED.—Position by a mechanical engineer; can do practical work anywhere in the machine shop; well posted on electricity; a first class draughtsman. Address T. C. K., care ELECTRICITY.

35 WANTED.—A works manager offers his services to economic manufacturer of insulated wires; can furnish his own private solid core rubber stocks for any grade of work; mixtures for weatherproof and finishes; designs for all kinds of insulating machines; scientific inexpensive methods of finding costs of manufacture; more than ten years' experience over a wide field; correspondence only with principals. Address "ECONOMICS," care ELECTRICITY.

36 WANTED.—Position as foreman by a man 35 years old; thoroughly familiar with special tools and piece work and well posted on the cost of manufacture of street railway motors and their appliances; will be open for engagement Jan. 1, 1896; can furnish best of references. Address A. J., care ELECTRICITY.

37 WANTED.—Electrician, who is a journalist and telegrapher, desires any good position where ability, energy and temperance are required; best of references. Address ABLE, care ELECTRICITY.

38 WANTED.—Position as chief engineer of a light or power plant; 5 years' experience in the construction and maintenance of alternating and direct current, high speed and Corliss central stations; technically educated; expert lineman and wireman. Address M. H. F., care ELECTRICITY.

39 WANTED.—Position as manager of any electrical business in Mexico; can speak Spanish and has a thorough scientific education obtained by four years' special study in a well known school of electrical engineering; references furnished. Address SPANISH, care ELECTRICITY.

40 WANTED.—Position to make myself generally useful with an electrical engineering party in charge of construction anywhere; have had five years' experience in setting up and maintaining private telephone lines and interior wiring. Address H. W. G., JR., care ELECTRICITY.

WRITE FOR PRICES.
ORIENT ELECTRICAL CO.
YOUNGSTOWN, OHIO.
MAKERS
INCANDESCENT
LAMPS.

Bargains in Electrical Machinery.

Two hundred Dynamos, direct current, alternating and arc; 200 Motors, from 1 to 800 H. P., any voltage; 100 Steam Engines, vertical, horizontal and marine type, high, moderate and slow speed, with or without boilers. Wanted a full description of what you want to buy or sell.

WRIGHT, 989 Monadnock Block, Chicago.

PLATINUM FOR ALL PURPOSES.
Scrap and Native
Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave.
NEWARK, N. J.
New York Office, 121 Liberty Street.

BANKERS AND BROKERS.**SPENCER TRASK & CO.,****BANKERS.**

Albany, New York.

DEALERS IN LOCAL SECURITIES.

WHITAKER & HODGMAN,**BOND AND STOCK BROKERS.**300 N. FOURTH STREET,
St. Louis, Mo.

Local and Street Railway Securities a Specialty.

A. E. AMES & CO.,**BANKERS AND BROKERS.**10 KING STREET, W.,
Toronto, Canada.

MEMBERS TORONTO STOCK EXCHANGE.

JOHN B. BARBOUR, JR.,**STOCK AND BOND BROKER.**404 TIMES BUILDING,
Pittsburg, Pa.

MEMBER PITTSBURG STOCK EXCHANGE.

HAMBLETON & CO.,**BANKERS.**9 SOUTH STREET,
Baltimore, Md.

Negotiators of Municipal and Corporate Loans.

INVESTMENT SECURITIES OF THE BEST CLASS A SPECIALTY.

Deposit Accounts received. Stocks, Bonds and other securities bought and sold. Private wire to New York, Philadelphia and Washington.

Letters of Credit issued, good in all parts of the world.

Street Railway Securities a Specialty.**W. E. HUTTON & CO.,****INVESTMENT BANKERS.**13-15 EAST 3D STREET,
Cincinnati, Ohio

Members Cincinnati and New York Stock Exchanges.

GORDON STRATHY & CO.,**STOCK BROKERS.**No. 9 ST. SACRAMENT STREET,
Montreal.

Strictly Commission Business Only.

H. GORDON STRATHY member Montreal Stock Exchange since 1870.

C. FRANKLIN NUGENT & CO.,**BANKERS.**

Providence, R. I.

ELECTRICAL ENGINEERING CO.,

311-313 SECOND AVE., SOUTH,

MINNEAPOLIS, MINN.

"Brokers" I

POSITIONS VACANT.**Free Advertising.**

Inquiries from employer in want of Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or other assistance from those possessed of technical experience in the various electrical lines, will be inserted in this column without charge, whether subscribers or not.

Applicants should enclose the necessary postage to insure the forwarding of letters.

Address all communications to Free Advertising Editor, "Electricity," New York.

10 WANTED.—An all-around machinist; married man preferred; one that has had some experience with keeping up street cars, and is willing to work at a moderate salary and prove himself the right man in the right place; must be a sober and energetic gentleman. Address KOKOMO care ELECTRICITY.

STEAM ENGINEERING

(Stationary, Locomotive, Marine); Mechanical Drawing; Architectural Drawing; Machine Design; Electricity; Architecture; Plumbing; Railroad, 31 COURSES Hydraulic & Bridge Engineering; Surveying and Mapping; Metal Pattern Cutting; Bookkeeping; Shorthand; English Branches; Mining; Metal Prospecting. All who study **GUARANTEED SUCCESS.** Fees Moderate, Advance or Installments. Circular Free; State subject you wish to study. International Correspondence Schools, Box 944, Scranton, Pa.

Typewriter Bargains.

All Standard \$100 Typewriters sold by us (under full guarantee) at \$25 to \$50, little used. Shipped, allowing examination and trial. Send postal for handsome colored Fin-de-Siècle Descriptive Price List of the Standard Machines. All makes exchanged and rented on liberal terms. Desks, one-half cost. Colored Price List of the AMERICAN STANDARD PITMAN SHORTHAND BOOKS (arranged for self-instruction) sent on application.

Consolidated Typewriter Exchange,
345 Broadway, New York.

Northwestern Telephone Mfg. Co.
Offices: 43 and 44 Loan & Trust Building,
MILWAUKEE, WIS.



Telephones, Switchboards, Magneto Bells, etc. Over 15 years of practical experience in the service with the licensees of the American Bell Telephone Co. a sufficient guarantee of the efficiency of our apparatus. All of our telephones are equipped with a Solid Back Transmitter, identical in principle with that used by the American Bell Telephone Co. for transmitting articulation a distance of 1,600 miles. Send for prices and mention this paper.

PROFESSIONAL.**FOREE BAIN,****CONSULTING ENGINEER,**

Electricity, Mechanics.

SOLICITOR OF PATENTS.

Expert in patent causes.

Suite 1657-59 Monadnock Bldg., - Chicago.

A. L. McRAE,**CONSULTING ELECTRICAL ENGINEER,**

316 N. Sixth Street, ST. LOUIS.

Estimates, Plans, Specifications, Examinations, Reports, Tests.

PATENTS,

Caveats, Trade-marks, Designs promptly and properly procured in the United States and all foreign countries.

High-class Work. Moderate Fees. Infringement Suits Conducted.

ALEXANDER & BARRY

If You Are Puzzled

Over some problem in Electrical Work reduce your perplexity to the form of a question, send it to **ELECTRICITY**, and have it answered in the "ANSWERS TO CORRESPONDENTS" Department. You can use this blank for convenience. . . .

To the Editor of **ELECTRICITY**.

Sir:

.....

.....

.....

.....

CLASSIFIED INDEX TO ADVERTISEMENTS.

For Alphabetical Index See Page IV.

AMMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N.J.

BANKERS AND BROKERS.

A. E. Ames & Co., 10 King St., W., Toronto, Canada.
John B. Barbour, Jr., Times Building, Pittsburg, Pa.
Hambleton & Co., 9 South St., Baltimore, Md.
W. E. Hutton & Co., 13-15 E. 3d St., Cincinnati, O.
C. Franklin Nugent & Co., Providence R. I.
Gordon Strathy & Co., 9 St. Sacrament St., Montreal, Canada.
Spencer Trask & Co., Albany, N. Y.
Whitaker & Hodgman, 800 N. Fourth St., St. Louis, Mo.

BATTERIES, STORAGE.

Electric Storage Battery Co., Drexel Building, Philadelphia, Pa.

BOILERS.

Abendroth & Root Mfg. Co., 28 Cliff St., N. Y.

CARBONS, BATTERY.

Electric Appliance Co., 242 Madison St., Chicago.

CIRCUIT BREAKERS.

Ward Leonard Electric Co., Bronxville, N. Y.

CONDENSERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

CONDUIT.

Electric Appliance Co., 242 Madison St., Chicago.
New York Insulated Wire Co., 15 Cortlandt St., New York.

CONSULTING ELECTRICAL ENGINEERS.

Forre Bain, Suite 1637-39 Monadnock Bldg., Chicago.
A. L. McRae, 316 N. Sixth street, St. Louis.

DRILLING MACHINES.

Gould & Eberhardt, Newark, N. J.

DYNAMOS AND MOTORS.

Colburn Electric Mfg. Co., 888 Main St., Fitchburg, Mass.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Siemens & Halske Electric Co., Monadnock Block, Chicago.
Stanley Electric Mfg. Co., Pittsfield, Mass.

EDUCATIONAL.

International Correspondence School, Scranton, Pa.
The Correspondence School of Technology, Cleveland, Ohio.

ELECTRICAL MACHINERY.

Chicago Edison Company, 139 Adams Street, Chicago, Ill.

FAN MOTORS.

Electric Appliance Co., 242 Madison st., Chicago, Ill.

FRED WATER HEATERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

FLUSH SWITCHES.

The Electric Protection Co., 1025 Filbert st., Philadelphia, Pa.

GEAR CUTTERS.

Gould & Eberhardt, Newark, N. J.

INSTRUMENTS, TESTING AND RECORDING.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114-120 William St., Newark, N. J.

LAMPS, ARC.

Electric Appliance Co., 242 Madison St., Chicago.

LAMPS, INCANDESCENT.

Beacon Lamp Co., New Brunswick, N. J.
Bryan-Marsh Co., 186 Liberty St., New York.
Buckeye Electric Co., Cleveland, Ohio.
Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.
Orient Electrical Company, Youngstown, O.

LAMPS, MINIATURE INCANDESCENT.

Bryan-Marsh Co., 186 Liberty st., New York.

LATHES.

Gould & Eberhardt, Newark, N. J.

LUBRICATING GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.

MACHINERY ELECTRICAL.

Warren P. Freeman Company, 106-108 Liberty St., New York.

METAL TUBING.

M. T. Horn, 42 Dey St., New York.

MICA.

A. O. Schoonmaker, 158 William St., New York.
Eugene Munsell & Co., 218 Water St., New York.

MOTORS.

See Dynamos and Motors.

PATENT ATTORNEYS.

Alexander & Davis, Washington, D. C.
A. M. Pierce, 80 Church street, New York.

PLATINUM.

Baker & Co., N. J. Railroad Ave., Newark, N. J.

PORCELAIN INSULATORS AND CLEATS.

Electric Appliance Co., 242 Madison St., Chicago.

RHEOSTATS.

Ward Leonard Electric Co., Bronxville, N. Y.

SEPARATORS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

SHAPERS.

Gould & Eberhardt, Newark, N. J.

STORAGE BATTERIES.

The Electric Storage Battery Co., Drexel Bldg, Philadelphia, Pa.

SUPPLIES, ELECTRIC RAILWAY.

Electric Appliance Co., 242 Madison St., Chicago.

SUPPLIES, GENERAL ELECTRICAL.

Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.

SWITCHBOARDS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

SWITCHES.

A. & J. M. Anderson, 289 A St., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.

TELEPHONES.

American Electric Telephone Co., Kokomo, Ind.
Electric Appliance Co., 242 Madison St., Chicago.
Farr Telephone & Construction Supply Co., Chicago, Ill.
Northwestern Telephone Mfg. Co., Milwaukee, Wis.
Western Telephone Construction Co., 230 South Clinton St., Chicago, Ill.

THEATRE DIMMERS.

Ward Leonard Electric Co., Bronxville, N. Y.

TOOL HOLDERS.

Gould & Eberhardt, Newark, N. J.

TRANSFORMERS.

Fort Wayne Electric Corporation, Fort Wayne Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

TROLLEYS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

TRUCKS.

Graham Equipment Co., Boston, Mass.

VOLTMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WATCHMAN'S TIME DETECTORS.

The American Watchman's Time Detector Co., 234-235 Broadway, New York.

WATTMETERS.

Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WIRES AND CABLES.

American Electrical Works, Providence, R. I.
Cresfield Electrical Works, 620 Atlantic Ave., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.
India Rubber & Gutta Percha Insulating Co., 15 Cortlandt St., New York.
New York Insulated Wire Co., 15 Cortlandt St., New York.
Okonite Co., 253 Broadway, New York.
Standard Underground Cable Co., Pittsburg, Pa.
W. R. Brixey, 203 Broadway, New York.

WRITING MACHINE.

Tower, Dawson & Co., 806 and 808 Broadway, New York.

ELECTRICITY

Vol. XIV.

New York, July 6, 1898.

No. 26

GRIMSHAW WHITE CORE WIRES,

Grimshaw White and Black Tapes,
Competition Line Wires,
Raven White Core Wires,
Vulca Electrical Wire Ducts.

MANUFACTURED BY

NEW YORK INSULATED WIRE CO.,

Chicago, New York, Boston,
320 Dearborn St. 15 Cortlandt St. 134 Congress St.
San Francisco, Cal., 115 New Montgomery St.

ELECTRICAL



Watchman's Time Detectors,
Magneto Watchman's Clock,
Electric Time System, Em-
ployee's Time Registers (8
kinds), Interior Telephones
(Intercommunicating).

Address for catalogues and
prices

The American Watchman's
Time Detector Co.,
J. S. MORSE, Treasurer,
234-235 Broadway, New York.

AETNA and HECLA Railway Insulators,
SWITCHES, SWITCHBOARDS and
LIGHTNING ARRESTERS.

ANDERSON LINE MATERIAL.

ALBERT & J. M. ANDERSON MFG. CO.,
289 A Street, Boston, Mass.

WRITE FOR PRICES.

THE ORIENT ELECTRICAL CO.
YOUNGSTOWN, OHIO.
MAKERS
INCANDESCENT
LAMPS

PLATINUM FOR ALL PURPOSES
Scrap and Native
Platinum Purchased.
BAKER & CO., New Jersey Railroad Ave.
NEWARK, N. J.
New York Office, 121 Liberty Street.

LEAD ENCASED CABLES.

OREFELD ELECTRICAL WORKS,
620 Atlantic Ave., Boston, Mass.



1889

Paris
Exposition
MEDAL



1893

World's
Fair
MEDAL



The Standard for Rubber Insulation.

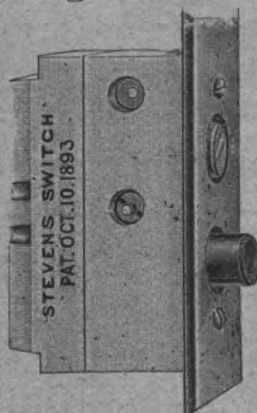
Okonite Wires, Okonite Tape, Manson Tape,
Candee Water-proof Wire.

Sole Manufacturers, THE OKONITE CO., Ltd.

WILLARD L. CANDER, } Managers.
H. DURANT CHEEVER, } 253 BROADWAY,
GEO. T. MANSON, General Supt. NEW YORK.
W. H. HODGINS, Secretary.

The Improved Stevens Flush Switch

Embodies the very highest points of superiority in Flush Switches.
Single Pole, Double Pole—Three Way, Four Way.



Single Switches or in gangs of any number.

Mats of any kind of wood to match house furnishings;
also open and closed wall boxes for single switches or gangs
of any number of switches.

We are now ready to make prompt delivery of

New Double Pole Switch

with front connections (see out).

Perfection in Flush Switches. Absolutely Water,
Damp and Fire Proof.

Write for Prices and Discounts.

THE ELECTRIC PROTECTION COMPANY,

MANUFACTURERS,

1026-1028 Filbert Street, Philadelphia, Pa.

NEW YORK: CHAS. D. SHAIN, 138 Liberty Street.
GEO. W. CONOVER, 1511 Monadnock Block, Chicago, Ill., agent for Michigan, Indiana, Illinois,
Wisconsin, Minnesota, Iowa and Missouri and the city of Cincinnati.
Pacific Coast—California Electrical Works, San Francisco, Cal.



Send for our new FAN MOTOR CATALOGUE.

We list and carry in stock only the best
of everything in this line.

ELECTRIC APPLIANCE COMPANY,

ELECTRICAL SUPPLIES.

242 Madison St.
CHICAGO.

IDEAL Circuit Breakers.

F. A. LA ROCHE & CO.,

652 Hudson Street, - NEW YORK.

HABIRSHAW
INSULATED
WIRES AND CABLES.
GLENWOOD WORKS,
YONKERS, N. Y.

New York Office, 15 Cortlandt Street. Tel-
ephone Call, 191 Cortlandt.



DIRECT-READING
AMMETERS or
VOLTMETERS,

like cut, reading from 0 to 10, at
\$1.50 each. 0-25 at \$3.00 each.

Cherry Electric Works,
25 & 27 Third Avenue, New York.



NEW YORK
STANDARD

PHILADELPHIA
FIBER
PAPER
RUBBER
CABLES.

UNDERGROUND

CEMENT
BRICK TILE
WOOD
CONDUIT.

CHICAGO
CABLE

HIGH GRADE
RUBBER AND
WEATHERPROOF
WIRES.

ST. LOUIS.
CO.

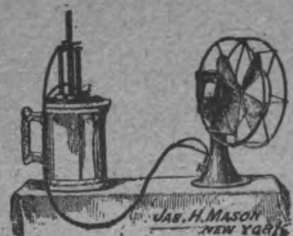
—FOR SALE:—

Second Hand

Direct Current Dynamos of 350, 700, 725, 800, 810, 900, 1075, 1350, 1610 and 2500 light capacity.
 Alternating current dynamos of 750, 900, 1300 and 2000 light capacities.
 Arc dynamos, 20, 24, 30, 40, 50 and 60 light, both 1200 and 2000 C. P.
 Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 H. P. Boilers, 100, 250, 375 and 500 H. P.
 Heaters, 150 and 1,000 H. P. Pumps, all sizes.

Write us for particulars and prices.

CHICAGO EDISON COMPANY,
 139 ADAMS STREET, CHICAGO.



DON'T DIE For Want of Breath. PORTABLE FAN OUTFITS.

(Received one order for 500 after two months' trial.)

**Design is Scientifically Correct.
 Construction is Practically Perfect.**

YOU CAN GUARANTEE YOUR CUSTOMERS ASSURED SATISFACTION.

No. 1 Outfit, consisting of No. 1 Motor, 4½ inch Fan and Battery.....	\$25.
No. 2 Outfit, consisting of No. 2 Motor, 8 inch Fan and Battery.....	7.50
No. 3 Outfit, consisting of Motor, 8 inch Four-Bladed Fan and Guard, mounted on pedestal, and 15 hour battery.....	10.00

Cost of operating one cent an hour. No waste when not in use.

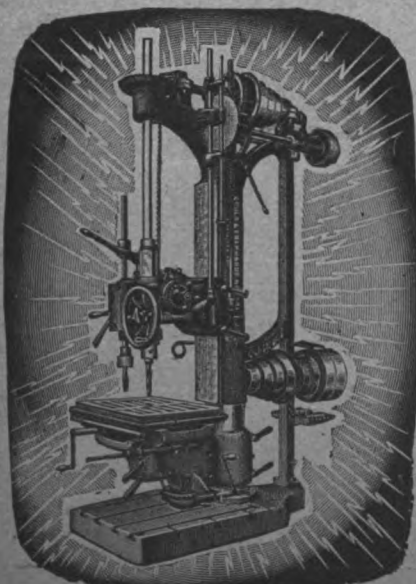
NO ACIDS TO HANDLE.

DISCOUNT TO TRADE.

Catalogue on application. Address

JAMES H. MASON, INVENTOR, 154 East 23d Street, New York.

EBERHARDT'S PATENT



DRILL PRESS
 WITH PATENT
 AUTOMATIC TAPPING ATTACHMENT
 and
 COMPOUND TAPPING TABLE.
GOULD & EBERHARDT,
 NEWARK, N. J., U. S. A.

Modern Examinations

OF STEAM ENGINEERS,

OR

Practical Theory Explained and Illustrated

BY W. H. WAKEMAN.

12mo., Cloth, 300 Pages, 53 Chapters.

Price \$2.00

Address

ELECTRICITY NEWSPAPER CO.,
 136 Liberty Street, New York.

If You See it in

ELECTRICITY

Tell the Advertiser So.

C. L. Pratt & Co.,
 Chicago.

Havana Cigars.

We give an extra discount to patrons of this paper.

Importers, Jobbers and Manufacturers. Box Trade a Specialty.

11 South Water Street.

**WESTERN TELEPHONE
 CONSTRUCTION CO.,**

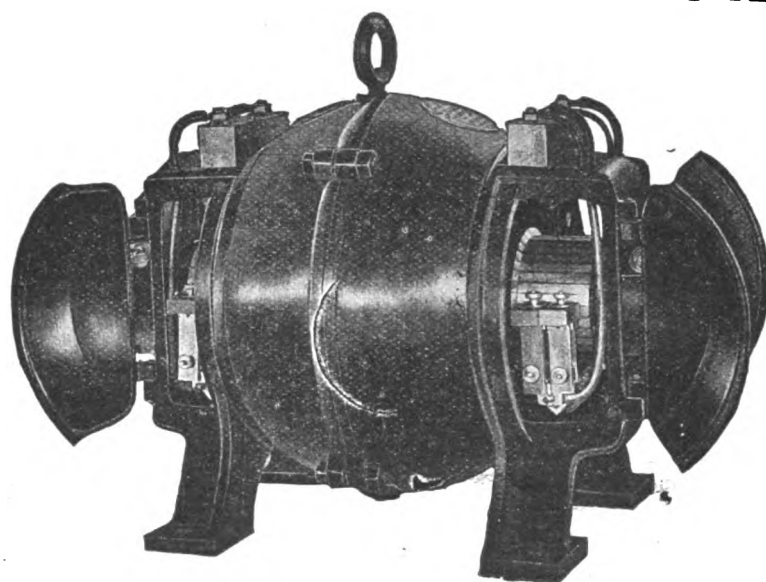
250 S. CLINTON STREET, CHICAGO.

LARGEST MANUFACTURERS OF

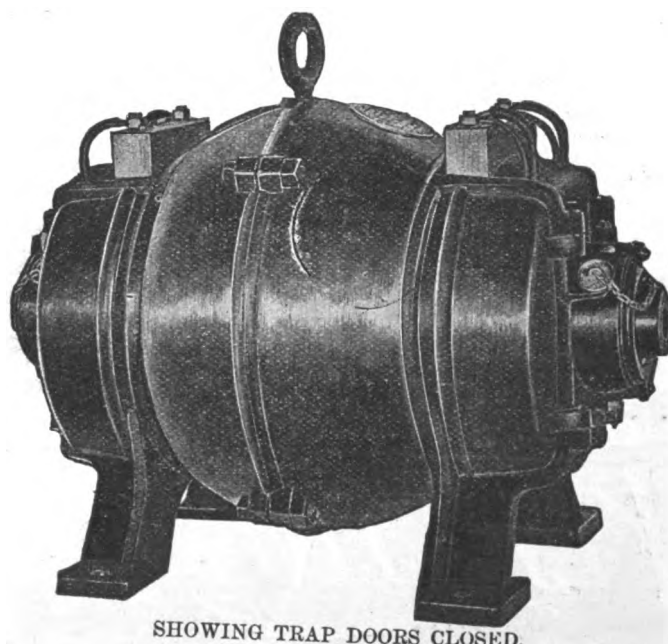
Telephones and Appliances,
 EXCLUSIVELY, IN THE UNITED STATES.

LUNDELL

Power Motors and Motor-Generators. New Round Type. The Latest and Best on the Market.



SHOWING TRAP DOORS OPEN.



SHOWING TRAP DOORS CLOSED.

These machines embody many new features and are the very essence of simplicity, durability and efficiency. No power user should buy without looking at the Lundell. No supply house should fail to entertain a proposition from us. New Catalogue just out.

SPRAGUE ELECTRIC COMPANY,

CHICAGO, Marquette Building.

LONDON

NEW YORK CITY

Habirshaw Wires and Cables

are the product of the best materials and skill in manufacture. They have long been recognized as the most **RELIABLE, DURABLE** and **ECONOMICAL** for all classes of work requiring the use of high-grade insulation. The danger of high potential transmission currents is eliminated when the circuits are installed with

HABIRSHAW

Red Core—White Core—Blue Core.

INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY,

J. W. GODFREY, Manager of Sales,
6196 15 Cortlandt Street, New York City.

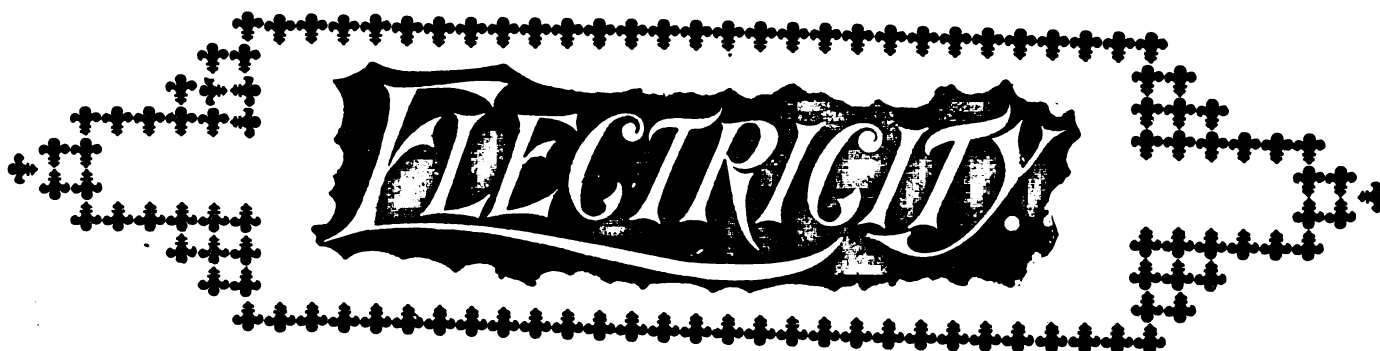
Main Office: GLENWOOD WORKS, YONKERS, N. Y.

ALPHABETICAL INDEX TO ADVERTISEMENTS.

For Classified Index See Page III.

A		E		L		S	
Abendroth & Root Mfg. Co.....		Electric Appliances Co.....	i	La Roche & Co., F. A.....	i	Sprague Electric Company.....	iii
American Watchman's Time Detector Co.....	i	Electrical Engineering Co.....	vi	Leonard Electric Co., Ward.....	x	S & B Electric Co.....	vi
American Electric Telephone Co.....	vi	Electric Protection Co., The.....	i			Standard Underground Cable Co.....	
American Electrical Works.....	vi	Eureka Tempered Copper Works.....		M		Stanley Electric Mfg. Co.....	xi
Ames & Co., A. E.....	vii	F		Mason, James H.....		Strathy & Co., Gordon.....	vii
Anderson, Albert and J. M.....	i	Fort Wayne Electric Corporation.....	xii	Manufacturers & Inventors' Electric Co.....	i		
Audel & Co., Theo.....		G		McRae, A. L., St. Louis, Mo.....	x	T	
B		Graham Equipment Co.....	viii	Mead Cycle Company.....	x	The Photographic Times.....	x
Baker & Co.....	x	Gordon Burnham Battery Company.....	ii	N		Trask & Co., Spencer.....	vii
Barbour, John B., Jr.....	vii	Goubert Mfg. Co.....	vi	New York Central Railroad.....	x		
Beacon Lamp Co.....		Gould & Eberhardt.....	ii	New York Insulated Wire Co.....	i	U	
Blair's Fountain Pen Co.....	x	H		Northwestern Telephone Mfg. Co.....	x	U. S. Mineral Wool Co.....	
Bryan-Marsh Co.....		Himmer, Vitalis.....	x	Nugent & Co., C. Franklin.....	vii		
C		Hambleton & Co.....	vii	O		W	
Cherry Electric Works.....	i	I		Okonite Co., The.....		Warrel Electric Manufacturing Co.....	
Chicago Edison Company.....	ii	India Rubber & Gutta Percha Insulating Co.....	ii	Orient Electrical Company.....	i	Warren Electric & Specialty Co.....	vi
Cresfield Electrical Works.....	i	J		P		Western Telephone Construction Co.....	ii
Colburn Electric Mfg. Co.....		Jersey Electric Co.....	v	Prouty, E.....	x	Weston Electrical Instrument Co.....	ix
D		K		Pearce, Wilfred G.....	x	Whitaker & Hodgman.....	vii
Dixon Crucible Co.....	vi	Kelley, Benj. F. & Son.....		Pratt & Co., O. L.....	ii	Williams, E.A., & Son.....	vi
Diamond Electric Co.....		Kintner, Charles J.....	vi				

BOUND VOLUMES OF



PRICE, \$5 EACH.

Electricity Newspaper Company,

136 LIBERTY STREET, NEW YORK.

**WE WILL PAY
12c. PER LB. FOR
SCRAP COPPER.**

Send Your
**BURNED OUT
LAMPS**

To Us for Renewal.

Our Cellulose Filament is Unsurpassed by Any.

WE WANT 1,000,000 BURNED OUT LAMPS

for which we will pay 2 cents each at our factory. Special price for series Lamps on bases.

We will supply Central Stations and other large consumers with the best quality of Renewed Lamps at 13 cents in barrel lots.

JERSEY ELECTRIC COMPANY,

742 Broad Street,



THE GOUBERT Feed Water Heater

Is the result of the best engineering experience in the utilization of exhaust steam. Meets the requirements of

High Pressure, Free Exhaust, Great Durability.

Specially adapted to

CONDENSING ENGINES.

All sizes, 50 to 5,000 HP.

The Stratton Separator

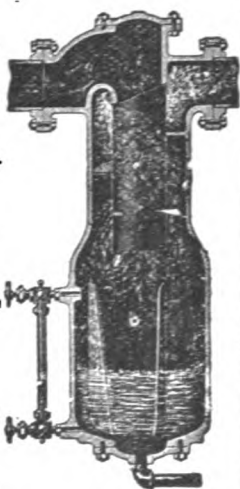
INSURES

Dry Steam.

Extracts all water from steam, no matter how much your boiler may prime or how long your steam pipe. The water is separated by centrifugal force.

An Absolute Safeguard. A Source of Economy.

Manufactured by



THE GOUBERT MFG. CO.,

14 and 16 Church St., cor. Cortlandt, New York.

FRANK N. PHILLIPS, President.
CHAS. H. WAGENSEIL, Treas.

EUGENE F. PHILLIPS,
General Manager.

E. ROWLAND PHILLIPS, Vice-President.
CHAS. R. REMINGTON, JR., Secretary.

American Electrical Works.

Providence, R. I.

Rare & Insulated Electric Wire.

Electric Light Line Wire.

Incandescent and Flexible Cords.

Railway Feeder

and Trolley Wire.

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

Cables for Aerial and Underground Use.

New York Store—P. C. ACKERMAN, 10 CORTLANDT STREET.

Chicago Store—F. E. DONOHUE, 241 MADISON STREET.

Montreal Branch—EUGENE F. PHILLIPS' ELECTRICAL WORKS.



PURE TEMPERED COPPER

CASTINGS, FLAWLESS,
SOUND, AND EXACT DU-
PLICATES OF PATTERNS

E. A. WILLIAMS & SON, 107 PLYMOUTH ST., JERSEY CITY, N. J.

BOMBARDMENT

We are being bombarded by customers who want our fans at the rate of one day's production a minute. They have tried them before and know a good thing when they see it. 4 1/2 inch fan outfit, complete, \$4.00; 6 inch, complete, \$4.80; 8 inch, complete, \$12.50; 10 inch, complete, \$17.00. Your discount to July 1st, thirty per cent. You are new to us and we want your trade. Money back if you don't find them the best and cheapest.

THE "S & B" ELECTRIC COMPANY,

74-76 Fulton Street, NEW YORK.

Catalogue No. 13—320 pages—now ready. Get one.



PATENTS.

CHARLES J. KINTNER, 45 Broadway, New York. Solicitor of Domestic and Foreign Patents and Expert in Patent Cases. Late Principal Examiner, Office of Electricity, U. S. Patent Office. Trade Marks, Labels and Designs. ELECTRICAL PATENTS a specialty.

ELECTRICAL ENGINEERING CO.,

311-313 SECOND AVE., SOUTH,
MINNEAPOLIS, MINN.

"Buckeye" Lamps.

Reliable Agents

To solicit subscriptions and advertising wanted by **ELECTRICITY** in every town. Big commissions.

COMPRESSED AIR

Published monthly. Now in its second year. The only periodical devoted exclusively to this subject. It is both theoretical and practical, progressive and up-to-date. Subscription, \$1 a year. Foreign, \$1.50. Send for sample copy. COMPRESSED AIR, 26 Cortlandt St., N. Y.

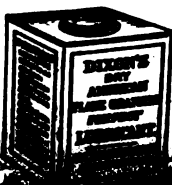
Dixon's Pure Flake Graphite

Is a Blessing to Every
Engine Room and Machine Shop.

A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.

Send for Pamphlet and Sample Sent Free.

D. DIXON CRUCIBLE CO., Jersey City, N. J.



American Electric Telephone Co.,

171-173 S. Canal St.,

CHICAGO, ILL., U. S. A.,

MANUFACTURERS OF

High Grade Telephone Apparatus, Long Distance Series and Bridging Type Telephones, Repeating Coils, Distributing Boards, etc., etc.

WE NOW HAVE READY FOR
THE MARKET OUR NEW

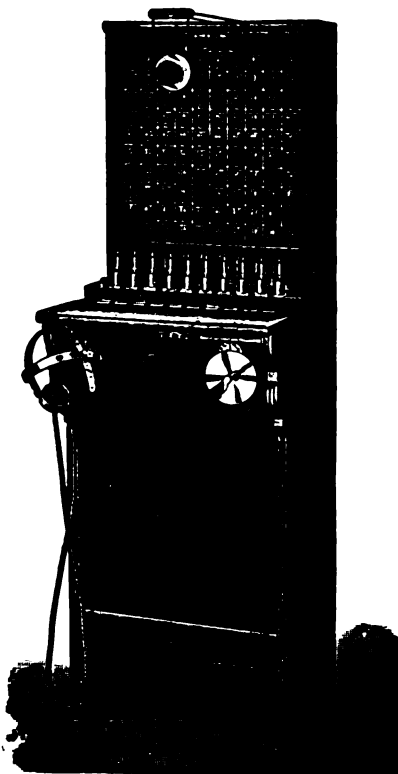
"Express" Switchboard.

This Board is a New Departure, the most Rapid Switching Apparatus ever devised, and will pay a daily dividend in quality of service rendered.

Self-restoring Drop.
Self-restoring Ring-off.
Rapid Ringing Device.

Each Drop and Jack Self-Contained in a Hard Rubber Case, can be removed and replaced in Board in one minute without disturbing a single connection.

Each Drop indicates if line is working properly.



Correspondence Solicited.
All Goods Guaranteed.

Complete 100 Drop "Express" Switchboard.

SITUATIONS WANTED.**Free Advertising.**

Inquiries from those seeking employment as Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or in other positions requiring technical experience or intimate acquaintance with the electrical trade, will be inserted in this column without charge. Each advertiser is invited to repeat his advertisement in case the first one produces no results.

It is the desire of the management of this paper to bring the unemployed and the employer together to their mutual benefit; and to this end they invite the former to make use of this column without charge. No advertisement exceeding five lines (about 85 words) will be inserted, but advertisers may write fully of their qualifications and these letters will be kept on file for future reference in filling vacancies which may occur.

Applicants should write clearly and distinctly and enclose postage to insure attention.

Address all communications to Free Advertising Editor, "Electricity," New York.

46 WANTED.—Position as superintendent of plant by an electrician; seven years' practical experience in light and power, both alternating and direct current; excellent reference. Address G. K., care ELECTRICITY.

47 WANTED.—Position by a young man who has had about ten years' experience in lighting and street railway plants; also understands electric machines; at present employed; best of reference; married; will go to any section of the country. Address D. C. W., care ELECTRICITY.

48 WANTED.—Position as superintendent or assistant superintendent of an electric lighting plant; have had 9 years' practical experience in electric lighting in all its branches; am a machinist by trade; can furnish the very best of references. Address L. E., care ELECTRICITY.

49 WANTED.—Position by electrician as superintendent or manager of a telephone exchange; 10 years' experience; best of references; married; strictly temperate. Address H. M., 617 Front st., Fort Madison, Ia.

50 WANTED.—Position as superintendent of an electric lighting plant within 100 miles of Chicago by licensed engineer with 8 years' practical experience; can furnish the very best of references. Address M. E. G., care ELECTRICITY.

51 WANTED.—Position by a young man with best education, both technical and general; some business experience; would prefer position in some department of electrical work where rapid advancement is the reward of industry and merit; at present employed. Address D. W., care ELECTRICITY.

52 WANTED.—Position by a young man experienced in winding armatures and testing electrical machines, viz., generators, motors, etc. Address A. A. E., care ELECTRICITY.

53 WANTED.—Position as engineer; theoretical and practical; about 5 years in street railway plants; before marine engineer with transatlantic company; open for engagement; best of references; married; strictly temperate. Address P. C. W., care ELECTRICITY.

54 WANTED.—A young man (23) with two years' practical experience in electrical work, graduate of technical school, desires position with electric railway or light and power plant. Address C. K., care ELECTRICITY.

55 WANTED.—A young man, 24 years old, wishes a situation as oiler or dynamo tender; understands pipe fitting. Address J. W., care ELECTRICITY.

56 WANTED.—Position by a young man, 17 years of age, in Greater New York, where I can learn electrical engineering; have good education; excellent reference as to character, honesty, etc. Address H. W. W., care ELECTRICITY.

57 WANTED.—Electric railway, power, light, etc.; young man, general electric experience 15 years; 4 years of electric railway operation; wishes position as superintendent or assistant; can manage amusements, electric lights or sell goods. Address TRACTION, care ELECTRICITY.

58 WANTED.—Position by a young man (23) as superintendent of electric light or pumping plant or telephone exchange; four years' experience with steam and electrical machinery; four years' technical course in English college; best references. Address R. R. K., care ELECTRICITY.

59 WANTED.—Position by an electrical engineer; three years' practical experience as manager of 200 K. W. light and power plant; graduate of Cornell University in the course of electrical engineering; All references furnished from former employer and from General Electric Company. Address MANAGER, care ELECTRICITY.

60 WANTED.—Is your telephone exchange paying? Inexperience is costly; efficient management means profit. Advertiser offers 14 years' experience; American and European Bell companies; clean record, well

BANKERS AND BROKERS.**SPENCER TRASK & CO..****BANKERS.**

Albany, New York.

DEALERS IN LOCAL SECURITIES.

JOHN B. BARBOUR, JR.,**STOCK AND BOND BROKER.**

404 TIMES BUILDING,

Pittsburg, Pa.

MEMBER PITTSBURG STOCK EXCHANGE.

Street Railway Securities a Specialty.**W. E. HUTTON & CO..****INVESTMENT BANKERS.**

13-15 EAST 3D STREET.

Cincinnati, Ohio

Members Cincinnati and New York Stock Exchanges

GORDON STRATHY & CO..**STOCK BROKERS,**

No. 9 St. SACRAMENT STREET,

Montreal.

Strictly Commission Business Only.

H. GORDON STRATHY member Montreal Stock Exchange since 1870.

WHITAKER & HODGMAN.**BOND AND STOCK BROKERS.**

300 N. FOURTH STREET,

St. Louis, Mo.

Local and Street Railway Securities a Specialty.

A. E. AMES & CO..**BANKERS AND BROKERS.**

10 KING STREET, W.,

Toronto, Canada.

MEMBERS TORONTO STOCK EXCHANGE.

HAMBLETON & CO..**BANKERS.**

9 SOUTH STREET,

Baltimore, Md.

Negotiators of Municipal and Corporate Loans.

INVESTMENT SECURITIES OF THE BEST CLASS A SPECIALTY.

Deposit Accounts received. Stocks, Bonds and other securities bought and sold. Private wire to New York, Philadelphia and Washington.

Letters of Credit issued, good in all parts of the world.

C. FRANKLIN NUGENT & CO..**BANKERS.**

Providence, R. I.

Enterprising Young Electrical Engineers

who desire to obtain a year's subscription to "Electricity" free of charge can do so by securing two new subscribers. Published weekly. \$2.50 per year. Address

ELECTRICITY NEWSPAPER CO.,**POSITIONS VACANT.****Free Advertising.**

Inquiries from employers in want of Electrical Engineers, Superintendents, Foremen, Salesmen, Dynamo-tenders, Constructing and Designing Engineers, Electro-metallurgists, or other assistance from those possessed of technical experience in the various electrical lines, will be inserted in this column without charge, whether subscribers or not.

Applicants should enclose the necessary postage to insure the forwarding of letters.

Address all communications to Free Advertising Editor, "Electricity," New York.

WANTED.—Energetic, honest and skillful man to take charge of one room in a manufacturing establishment; must be accurate machinist, good brass worker and understand finishing. He must be familiar with the construction of light, quick trains and the finish of fine instruments. Apply at once, stating age, experience, last position, references (not required). Minimum pay allowed during 30 day trial. Regular pay desired if accepted. Address FIRE ALARM, care ELECTRICITY.

WANTED.—Telephone inspector who can do line work; Southern town; 125 telephones; low wages to begin. Address, with reference, giving experience. H., care ELECTRICITY.

WANTED.—Experienced man, thoroughly competent to take charge of an incandescent lamp factory in all its details. Address, with particulars, M., care ELECTRICITY.

How Two Boys Made Their Own Electrical Apparatus.

BY THOMAS M. ST. JOHN.

The book contains directions for making all kinds of simple apparatus for the study of elementary electricity.

Bound in cloth. Price \$1.00.

Address

ELECTRICITY NEWSPAPER CO.,

136 Liberty St., New York.

Blue Print Paper

for making duplicate copies of drawings. Finest quality. Lowest price.

WE MANUFACTURE

Drawing Instruments

of the finest grade. Send for Catalogue D. Drawing paper and supplies. Cameras and photo materials. Bon Ton Cameras 3 1/2 x 8 1/2 \$5, delivered at any express office. Finest \$5 Camera, Catalogue P.

THOS. H. McALLIN & CO.,

1080 Arch Street, Philadelphia.

INVESTORS

Need to learn of the value and permanency of the investments they make.

ELECTRICITY

is the only publication fearless enough to present information which will enable investors to discriminate between

SAFE and UNSAFE

Electrical Investments

ELECTRICITY wants subscription and advertising agents in every city and



DON'T spend all your earnings for coal or on car and track repairs. Show you are up-to-date by running up-to-date equipment. Our trucks and steel-framed cars will help you earn dividends. Our idea of rolling stock is to make it light and strong and equip it with our Equalized Brakes, which avoids flat wheels and accidents. Write us when you are in the market for NEW IDEAS.

GRAHAM EQUIPMENT CO.

ANY ELECTRICAL BOOK Published in America or Europe will be sent postpaid on receipt of price by **ELECTRICITY NEWSPAPER CO., 136 Liberty Street, N. Y.**

Now is the time to Subscribe for
The Brightest and **ELECTRICITY** Most Readable of all
ELECTRICAL **JOURNALS.**

SUBSCRIPTION PRICE,

\$2.50 per Year.

CLASSIFIED INDEX TO ADVERTISEMENTS.

For Alphabetical Index See Page IV.

AMMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.
Cherry Electric Works, 27 Third Avenue, New York.

BANKERS AND BROKERS.

A. E. Ames & Co., 10 King St., W., Toronto, Canada.
John B. Barbour, Jr., Times Building, Pittsburgh, Pa.
Hambleton & Co., 9 South St., Baltimore, Md.
W. E. Hutton & Co., 13-15 E. 8d St., Cincinnati, O.
C. Franklin Nugent & Co., Providence, R. I.
Gordon Strathy & Co., 9 St. Sacrament St., Montreal, Canada.
Spencer Trask & Co., Albany, N. Y.
Whitaker & Hodgman, 800 N. Fourth St., St. Louis, Mo.

BOILERS.

Abendroth & Root Mfg. Co., 28 Cliff St., N. Y.

CARBONS BATTERY.

Electric Appliance Co., 242 Madison St., Chicago.

CIRCUIT BREAKERS.

Ward Leonard Electric Co., Bronxville, N. Y.

COPPER.

Eureka Tempered Copper Company, North East, Pa.
E. A. Williams & Son, 107 Plymouth St., Jersey City, N. J.

CONDENSERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

CONDUIT.

Electric Appliance Co., 242 Madison St., Chicago.
New York Insulated Wire Co., 15 Cortlandt St., New York.

CONSULTING ELECTRICAL ENGINEERS.

A. L. McRae, 316 N. Sixth Street, St. Louis.
The Frank B. Rae Engineering Co., Chicago, Ill.

DRILLING MACHINES.

Gould & Eberhardt, Newark, N. J.

DYNAMOS AND MOTORS.

Colburn Electric Mfg. Co., 888 Main St., Fitchburg, Mass.
Fort Wayne Electric Corporation, Fort Wayne, Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.
Sprague Electric Company, 20 Broad St., New York.

ELECTRICAL MACHINERY

Chicago Edison Company, 189 Adams Street, Chicago, Ill.

FAN MOTORS.

Electric Appliance Co., 242 Madison St., Chicago, Ill.
James H. Mason, 154 East 23d St., New York.
S & B Electric Company, 74-66 Fulton St., New York.

FEED WATER HEATERS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

FLUSH SWITCHES.

The Electric Protection Co., 1026 Filbert St., Philadelphia, Pa.

GEAR CUTTERS.

Gould & Eberhardt, Newark, N. J.

INSTRUMENTS, TESTING AND RECORDING.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114-120 William St., Newark, N. J.

LAMPS, ARC.

Electric Appliance Co., 242 Madison St., Chicago.

LAMPS, INCANDESCENT.

Beacon Lamp Co., New Brunswick, N. J.
Bryan-Marsh Co., 136 Liberty St., New York.
Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.
Orient Electrical Company, Youngstown, O.
Warren Electric & Specialty Co., Warren, O.

LAMPS, MINIATURE INCANDESCENT.

Bryan-Marsh Co., 136 Liberty St., New York.

LATHES.

Gould & Eberhardt, Newark, N. J.

LUBRICATING GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.

MOTORS.

See Dynamos and Motors.

PATENT ATTORNEYS.

Davis & Davis, Washington, D. C.
Charles J. Kintner, 45 Broadway, New York.

PLATINUM.

Maker & Co., N. J. Railroad Ave., Newark, N. J.

PORCELAIN INSULATORS AND CLEATS.

Electric Appliance Co., 242 Madison St., Chicago.

RHEOSTATS.

Ward Leonard Electric Co., Bronxville, N. Y.

SEPARATORS.

Goubert Manufacturing Co., 14, 16 Church Street, New York.

SHAPERS.

Gould & Eberhardt, Newark, N. J.

SUPPLIES, GENERAL ELECTRICAL.

Electric Appliance Co., 242 Madison St., Chicago.
Electrical Engineering Co., Minneapolis, Minn.

SWITCHBOARDS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

SWITCHES.

A. & J. M. Anderson, 289 A St., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.

TELEPHONES.

American Electric Telephone Co., Kokomo, Ind.
Electric Appliance Co., 242 Madison St., Chicago.
Northwestern Telephone Mfg. Co., Milwaukee, Wis.
Western Telephone Construction Co., 250 South Clinton St., Chicago, Ill.

THEATRE DIMMERS.

Ward Leonard Electric Co., Bronxville, N. Y.

TOOL HOLDERS.

Gould & Eberhardt, Newark, N. J.

TRANSFORMERS.

Fort Wayne Electric Corporation, Fort Wayne Ind.
Stanley Electric Mfg. Co., Pittsfield, Mass.

TROLLEYS.

A. & J. M. Anderson, 289 A St., Boston, Mass.

TRUCKS.

Graham Equipment Co., Boston, Mass.

VOLTMETERS.

Electric Appliance Co., 242 Madison St., Chicago.
Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WATCHMAN'S TIME DETECTORS.

The American Watchman's Time Detector Co., 234-235 Broadway, New York.

WATTMETERS.

Weston Electrical Instrument Co., 114 William St., Newark, N. J.

WIRES AND CABLES.

American Electrical Works, Providence, R. I.
Orefeld Electrical Works, 620 Atlantic Ave., Boston, Mass.
Electric Appliance Co., 242 Madison St., Chicago.
India Rubber & Gutta Percha Insulating Co., 15 Cortlandt St., New York.
New York Insulated Wire Co., 15 Cortlandt St., New York.
Okonite Co., 238 Broadway, New York.
Standard Underground Cable Co., Pittsburg, Pa.

WESTON

Standard Portable Direct-Reading

VOLTMETERS, MILLIVOLTMETERS,
VOLTAMMETERS, AMMETERS,
MILLIAMMETERS, OHMMETERS,
GROUND DETECTORS and CIRCUIT
TESTERS,
PORTABLE GALVANOMETERS.



Our Portable Instruments are recognized as **THE STANDARD** the world over. The **SEMI-PORTABLE LABORATORY STANDARDS** are still better. Our **STATION VOLTMETERS** and **AMMETERS** are unsurpassed in point of extreme accuracy and lowest consumption of energy.

Weston Electrical Instrument Company,

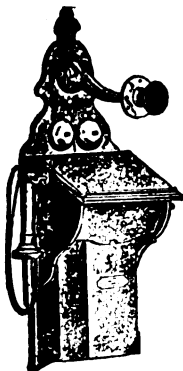
114-120 William Street, NEWARK, N. J., U. S. A.

MISCELLANEOUS.

Ventilating Fan Controllers.

Ward Leonard Electric Co.,
Bronxville, N. Y., U. S. A.

Northwestern Telephone Mfg. Co.
Offices: 43 and 44 Loan & Trust Building,
MILWAUKEE, WIS.



Telephones, Switchboards, Magneto Bells, etc. Over 15 years of practical experience in the service with the licensees of the American Bell Telephone Co., a sufficient guarantee of the efficiency of our apparatus. All of our telephones are equipped with a Solid Back Transmitter, identical in principle with that used by the American Bell Telephone Co. for transmitting articulation a distance of 1,600 miles.
Send for prices and mention this paper.

SEND FOR A BICYCLE
High Grade '98 Models, \$14 to \$40.
GREAT CLEARING SALE of '97 and '98 models, best makes, \$9.75 to \$18. Sent on approval without a cent payment. Free use of wheel to our agents. Write for our new plan "How to Earn a Bicycle" and make money. SPECIAL THIS WEEK—40 high grade '97 models (slightly shopworn), \$10.75 each. "Wandering Wheel," a souvenir book of art, FREE for stamp while they last.
J. L. MEAD CYCLE COMPANY, CHICAGO.

PROUTY ELECTRO-GASOLINE ENGINES.
The simplest, most reliable and practical working engine on the market. For particulars, sizes and prices, address
E. PROUTY,
85 Dearborn St., Chicago, U.S.A.

Bargains in Electrical Machinery.

Two hundred Dynamos, direct current, alternating and arc; 200 Motors, from 1 to 800 H. P., any voltage; 100 Steam Engines, vertical, horizontal and marine type, high, moderate and slow speed, with or without boilers. Wanted a full description of what you want to buy or sell.
WRIGHT, 989 Monadnock Block, Chicago.

"Standard Wiring,"

FOR ELECTRIC LIGHT AND POWER.

By H. C. CUSHING, JR.,
Electrical Inspector Fire Underwriters' Tariff Association of New York.

Adopted by the Fire Underwriters of the United States.

It contains tables, formulas and rules for every system of inside and outside wiring. Fifth edition. Russia leather cover. Price \$1.

Address
ELECTRICITY NEWSPAPER CO.,
136 Liberty Street, New York.

DON'T BE "A BUTTON PRESSER,"
for he is a poor specimen of humanity who is contented to press the button, let others do the rest, and then claim the results as his own. To become a successful Photographer you must read
THE PHOTOGRAPHIC TIMES,
40 and 42 East 11th St., New York City.
Send 25 cents for a sample number, containing a beautiful photograph of a landscape and from 10 to 100 instructions, including recipes of the secrets of the principal camera and photographic processes of the world.

PROFESSIONAL.

A. L. McRAE,
CONSULTING ELECTRICAL ENGINEER,
316 N. Sixth Street, ST. LOUIS.
Estimates, Plans, Specifications, Examinations, Reports, Tests.

PATENTS,

Caveats, Trade-marks, Designs promptly and properly procured in the United States and all foreign countries.

High-class Work. Moderate Fees. Infringement Suits Conducted.

DAVIS & DAVIS,

(Successors to Alexander & Davis),

Opposite Patent Office. Washington, D. C.

G. WILFRED PEARCE,
Electrical, Steam and Compressed Air Apparatus,
SAINT PAUL BUILDING,
NEW YORK.

The Frank B. Rae Engineering Company,

ELECTRICAL AND MECHANICAL ENGINEERS.

Suite 910, Fort Dearborn Building,
No. 124 Monroe Street, Chicago, Ill.

Member American Institute
Electrical Engineers.

This company makes a specialty of "Municipal Engineering," estimates of cost of plant, cost of operation, plans, specifications, supervision and final tests upon Electric Lighting and Water Works Plants.

References by permission:
Hon. H. S. Pingree, Governor, Lansing, Mich.
Hon. John MacVicar, Mayor, Des Moines, Iowa.
Hon. Edward W. Brown, Mayor, Rockford, Ill.
Hon. W. G. Mullinger, Mayor, Cumberland, Md.
Also to the Mayors of the following cities:
Madison, Wisconsin; Sycamore, Woodstock, Illinois; London, Bryan, Columbiana, Ohio; Lansing, Hillsdale, Negaunee, Evert, West Bay City, Michigan; Springfield, New York, etc.
Correspondence solicited.

YOU WILL BE INTERESTED
in reading

The Manufacturer,

a weekly Magazine published by the Manufacturers' Club of Philadelphia.

It is edited by specialists on economic subjects, and contains a fund of useful and valuable information to all business men.

Manufacturers and merchants desirous of extending trade at home and abroad should write for advertising rates. Over 1,000 leading firms are represented in the ownership of the journal. Millions of dollars are spent each year by these firms in the process of buying and selling.

SUBSCRIPTION.....\$3.00 per year.
Including 12 monthly International Editions.

Address
THE MANUFACTURER,
Philadelphia, Pa.

Do You Use a Wiring Table?

Certainly. But do you know how that wiring table was made and why you take the various steps to get results? If not, you are not using the table intelligently.

Grier's Wiring Tables and How to Use Them

should be in your hands. Sent postpaid on receipt of \$1.

ELECTRICITY NEWSPAPER CO.,
136 Liberty St., New York.

MISCELLANEOUS.

SARATOGA, THOUSAND ISLANDS, ADIRONDACK MOUNTAINS.

The greatest of American health and pleasure resorts are directly reached by the through parlor and sleeping cars of the New York Central. The service by this great line is elegant and luxurious in every particular, strictly maintaining the apt title bestowed upon it of "America's Greatest Railroad."

For a book or folder descriptive of the above resorts, together with the time and rates of fare, send a 2-cent stamp to George H. Daniels, General Passenger Agent, Grand Central Station, New York

DO YOU know the Constitution of the United States?

Every citizen of the republic should be familiar with the Constitution and all the charters of our national policy. You can find them collected in

Our National Charters,

a pamphlet giving the Constitution and Amendments, The Declaration of Independence, the Articles of Confederation, Washington's Farewell Address, the Dictatorship Conferred on Washington, the Ordinance of 1787, the Monroe Doctrine, and the Emancipation Proclamation. As a matter of patriotic pride, if for no other reason, every American should be familiar with these documents. Price 50 cents.

Shall I Study Law?

BY ONE WHO HAS TRIED.

This book was written for men who are thinking of taking up the law as a special study, either for practice, for general culture, or for business purposes, and discusses the matter fully, giving reasons for and against it, together with much practical instruction, enabling men to know what to do in answer to this question.

Paper bound, 69 pages. Price 50c.

Address Electricity Newspaper Co.,
136 Liberty St., New York.

The Motor Engineer's AND Electrical Worker's Handbook.

BY WILLIAM LINTERN.

This book in pocket form will be found extremely valuable as a book of reference for the use of motor engineers and street railway men. It contains diagrams of controller connections and combinations, and gives various methods of testing, both simple and reliable.

Price, morocco cover, \$1.00; cloth cover, 50 cents. Address

ELECTRICITY NEWSPAPER CO.
136 Liberty St., New York.

MISCELLANEOUS.

DO YOU NEED SMALL DRY BATTERIES?
If so, write and tell what you want.
1/2x2 1/2 inches 1.5 volts; 5/8x2 1/2 inches 5 amperes.
VITALIS HIMMER,
Pioneer Manufacturer of Dry Batteries,
162 William Street, New York

THE TELEPHONE

PUBLISHED MONTHLY.

The Only Journal in the World Devoted Exclusively to Telephony.

Should be Read by Every Man Interested in the Development of the Art.

SAMPLE COPY FOR THE ASKING.

SUBSCRIPTION RATES \$1.50 PER ANNUM
IN ADVANCE.

THE TELEPHONE PUBLISHING CO.,
P. O. Box 1178, CHICAGO, ILL.

Blair's Ink Making Security Fountain Pens.

Producing their own ink by merely filling the holder with water, which turns into a deep black, purple or scarlet copying ink, enabling the owner to produce the right ink at any time or place. The ink-making quality will last one year and can be renewed at a trifling cost, saving the price of the pen in a few months.

They cannot leak.
No weak internal mechanism.
Regular shape 14 carat Gold Pens.
Upper feed bars on long point pens.
Under feed-bars on short point. They cost no more, even considerably less, than the old makes.
More than 12,000 sold in six weeks.

To give our readers this Absolutely Perfect Fountain Pen at a moderate price, we have made an arrangement with Blair's Fountain Pen Company of New York to furnish our subscribers their "Security Fountain Pens" at the following low

PRICES:

No. 1 Gold Pen, fine point, at \$1.75.
No. 2 Gold Pen, fine or stub point, \$2.
No. 3 Gold Pen, fine or stub point, \$2.50.
No. 4 Gold Pen, fine or stub point, \$3.
Handsomely Chased and Gold Mounted, 75 cents extra.

To insure getting these pens at prices named, orders for them should be sent direct to this office with the price of the pen desired. Should you wish to have them insured against loss in the mails, send eight cents extra. Address

ELECTRICITY NEWSPAPER CO.
136 Liberty St., New York.

Electricity and Magnetism.

Lessons of the Chicago School of Electricity.

A series of easy progressive lessons prepared by a large number of the leading electricians of this country especially for students beginning a systematic course of study in electrical engineering.

84 Lessons, covering 325 pages, handsomely bound in cloth.

Sent, postpaid, on receipt of price, \$2.

ELECTRICITY NEWSPAPER CO.
136 Liberty Street, New York.

TWO-PHASE GENERATORS

Entirely novel in construction and having

No Moving Wire, No Collector, Slow Speed,
Better Inherent Regulation, Higher Efficiency,

than any alternating machine on the market.

SELF-STARTING TWO-PHASE MOTORS,

superior in many ways to direct current motors.

THE BEST TRANSFORMER.

These are the essential elements in our

TWO-PHASE SYSTEM,

which is the only practically completed system in operation to-day for furnishing light and power from the SAME ALTERNATING GENERATOR AND CIRCUIT.

STANLEY ELECTRIC MFG. CO.,
PITTSFIELD, MASS.

BRANCH OFFICES:

CHICAGO, 306 Dearborn Street.

NEW YORK, Rooms 1006 and 1007 Empire Bldg., Broadway and Reector Street.

BOSTON, Equitable Building.

SAN FRANCISCO, 300 California Street.

ST. LOUIS, MO., Western Electrical Supply Co.

ANDERSON, S.C.

The Royal Electric Co., Montreal, Can., are exclusive licensees for the manufacture of the S. K. C. System in the Dominion of Canada.

THE BEST BOOKS

FOR

AMATEURS AND ELECTRICAL WORKERS.

ELECTRICAL [INSTRUMENT MAKING FOR AMATEURS.]—A practical Hand-book with 48 Illustrations. By S. R. Bottone. 12mo cloth. \$0.50
DYNAMO AND MOTOR BUILDING FOR AMATEURS.—A concise hand-book illustrated with working drawings. By C. D. Parkhurst. 12mo cloth. 1.00
ELECTRIC TOY MAKING FOR AMATEURS.—A fully illustrated description showing how to construct Batteries, Magnets, Motors, Dynamos and miscellaneous toys. By T. O'Connor Sloane. 12mo cloth. 1.00

DOMESTIC ELECTRICAL WORK.—Tells how to wire buildings for Bells, Burglar Alarms, Annunciators, Electric Gas Lighting, etc. Illustrated with 22 diagrams. By W. A. Wittbecker. 12mo paper. \$0.25
PRACTICAL ELECTRICS.—A universal hand-book on every-day, electrical matters, including Bells, Carbons, Induction, Intensity and Resistance Cells, Dynamos, Measurements, Microphones, Phonographs, Storage Batteries and Telephones. pp. 135. 12mo cloth. 0.75

Any of These Works Sent Postpaid Upon Receipt of Price.

The set of five and one year's subscription to **ELECTRICITY** will be sent for \$5.00.

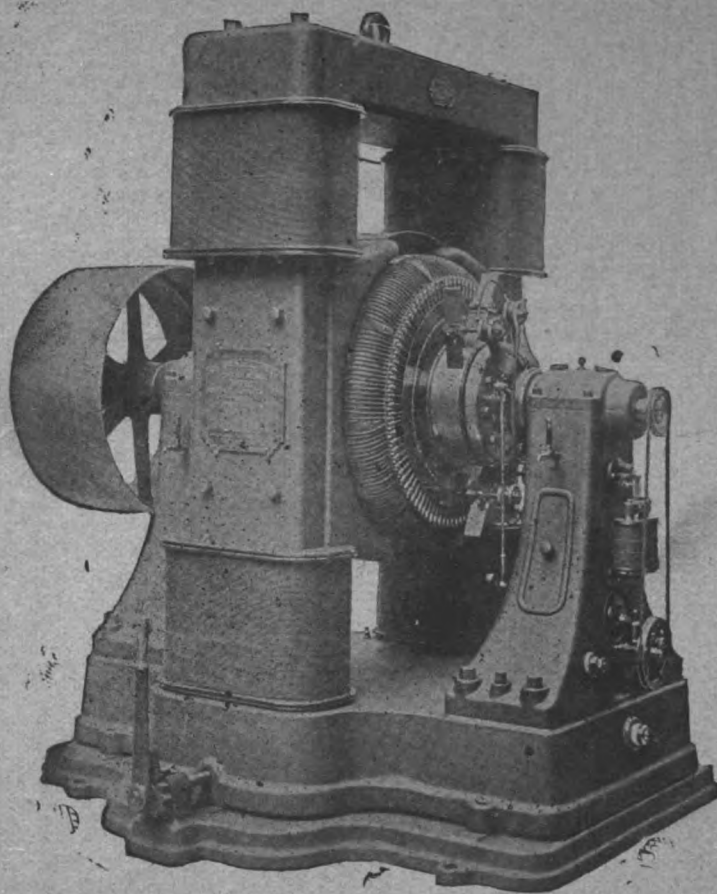
ELECTRICITY NEWSPAPER CO.,

136 LIBERTY ST., NEW YORK.

Digitized by Google

FORT WAYNE ELECTRIC CORPORATION, FORT WAYNE, IND.

Apparatus for Light and Power.



No. 10 "Wood" Arc Dynamo.

Embodies all the latest improvements in electrical machinery. Has many superior advantages. Is simple and durable.

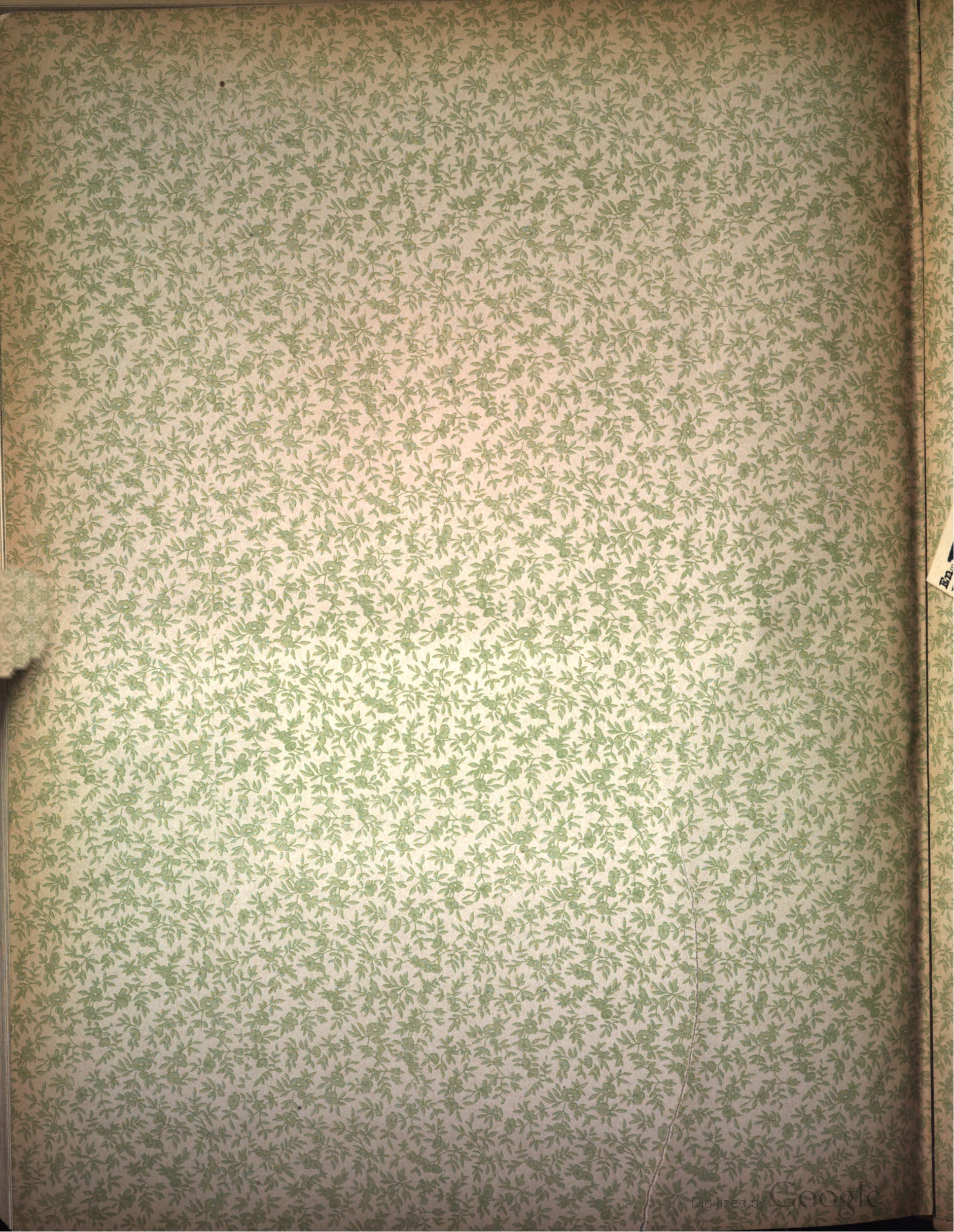
BRANCH OFFICES:

NEW YORK CITY, 115 Broadway.
PHILADELPHIA, PA., 101-104 The Bourse.
SYRACUSE, N. Y., 717 Dillaye Memorial Building.
NEW ORLEANS, LA., 145 Carondelet Street.
CINCINNATI, OHIO, 402 Neave Building.
ATLANTA, GA., 25 Marietta Street.
SAN FRANCISCO, CAL., 18 Second Street.

CHICAGO, ILL., 621 to 625 Marquette Building.
BOSTON, MASS., Room 60, Equitable Building.
PITTSBURGH, PA., 918 Park Building.
DES MOINES, IOWA., 308 Observatory Bldg.
ST. PAUL, MINN., 207 Newspaper Row.
ST. LOUIS, MO., 321 Security Building.
KANSAS CITY, Mo., W. G. DeCelle, Lock Box 30.

EXPORT DEPARTMENT, 115 Broadway, New York City.

... XIV, 50
'10N
er.



En^{ry} Electricity,

11-10-04
V.14

REMOVER'S NAME

UNIVERSITY OF MINNESOTA
sci.pere v.14

Electricity.



3 1951 000 840 912 Q

